Vol. 9, No. 4 APRIL, 1954

AGRICULTURAL CHEMICALS

In This Issue:

On the Subject of Delivery

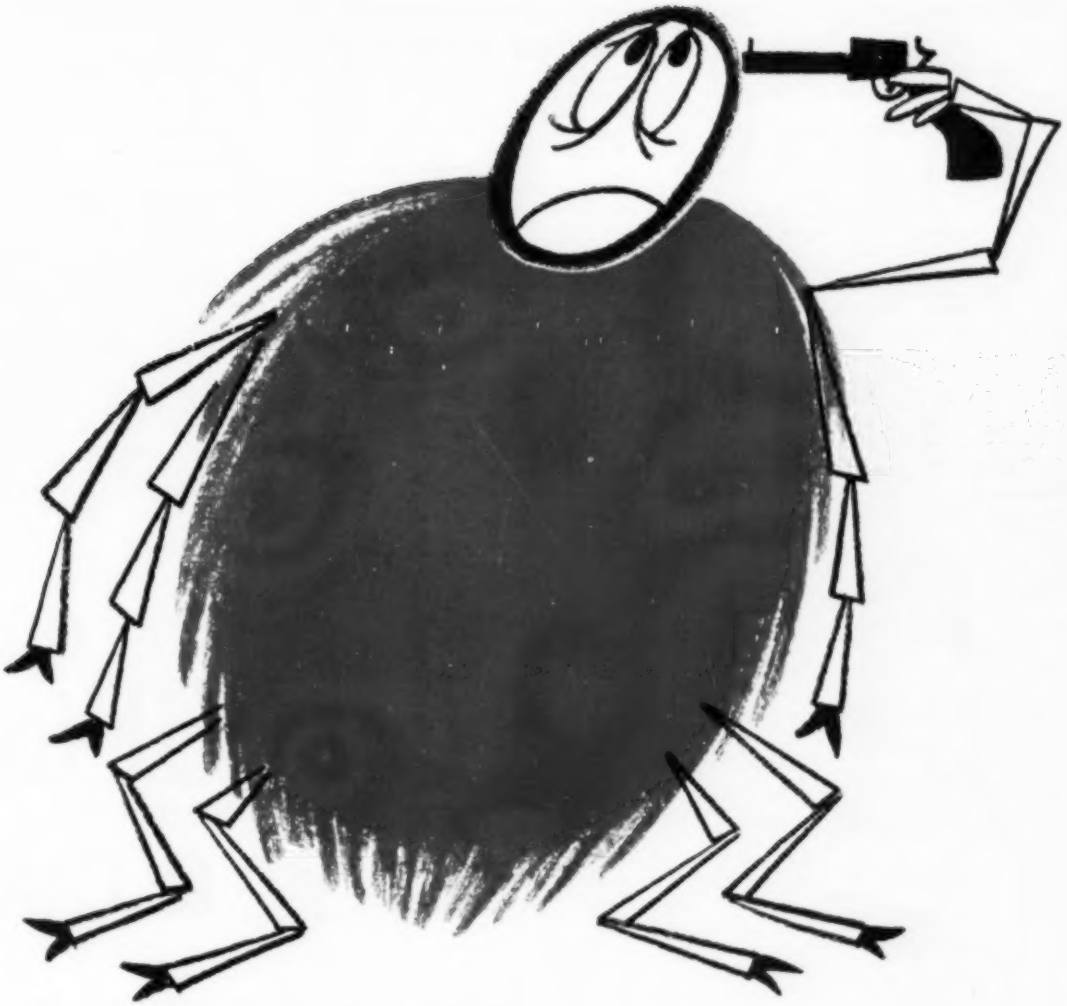
Since our beginning twenty years ago, alert, dependable service has been our watchword.

Whether it be regular scheduled service or emergency shipments, Potash Company of America has justified its reputation for timeliness of delivery.

We welcome the opportunity to make "on-time" delivery to you.

POTASH COMPANY of AMERICA
Carlsbad, New Mexico

General Sales Office . . . 1625 Eye Street, N. W., Washington, D. C.
Midwestern Sales Office . . . First National Bank Bldg., Peoria, Ill.
Southern Sales Office . . . Candler Building, Atlanta, Ga.



For you . . . there's a future with Attaclay

Carriers for soil pesticides

We are leaders in developing granular grades for soil pesticides, herbicides and fungicides. Write for samples and for your copy of our latest report on this promising field.

This unhappy spider mite obviously doesn't benefit through pesticide dusts formulated with Attaclay. So let's forget him, and take a look at the people with a *future* in Attaclay.

Formulators in ever-growing numbers have adopted Attaclay as their *across-the-board* carrier, diluent, and conditioner. These men have product lines that may range from six to sixty formulations, covering dust bases, wettable powders, and finished dusts. The savings brought by Attaclay in simplified inventory alone mean vastly lowered costs. Scheduling and procurement problems are next to non-existent, and carrier-handling costs are cut to the bone.

Men in the trade prefer Attaclay as a carrier because of time-proven experience with its versatility and high sorptivity. Attaclay shortens cycle times and cuts "clean-out" downtime in *any* kind of reduction mill or impregnating blender. It takes all of the popular toxicants in stride. It gives new meaning both to processing ease and product quality.

Can you see across-the-board savings in your future with Attaclay? Let us give you the whole story.

ATTAPULGUS MINERALS & CHEMICALS CORPORATION

DEPT. P, 210 WEST WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Meeting Calendar

April 13-14—Western Cotton Production Conference. Phoenix. Ariz.

April 13-14 — Fifth Annual Short course on insect and rodent control for sanitarians. Purdue University. Lafayette. Ind.

April 29-30—Cal. Fertilizer Assoc., 2nd Annual Conference. Moose Hall. Visalia. Cal.

May 4-6—Fertilizer Section. North Carolina. Annual Safety Conf.. Sir Walter Hotel. Raleigh.

May 6-8—Fertilizer Section. Governor's Safety Conference. Lord Baltimore Hotel. Baltimore. Md.

May 21—Fertilizer Section. Va. Annual State-wide Safety Conf.. Monticello Hotel. Norfolk.

May 23-25 — Chemical Specialties Manufacturers Assn.. mid-year meeting. Netherlands Plaza Hotel. Cincinnati. O.

June 10-13—American Plant Food Council. The Homestead. Hot Springs. Va.

June 13 — Executive Committee. Fertilizer Section. National Safety Council. White Sulphur Springs. W. Va.

June 14-16—National Fertilizer Association. Greenbrier Hotel. White Sulphur Springs. W. Va.

June 21-22—Assn. Southern Feed & Fert. Control Officials. Skirvin Hotel. Oklahoma City. Okla.

June 22-24 — Pacific Slope Branch. E.S.A.. Pilot Butte Inn. Bend. Ore.

June 28-29—North Central Phytopathological Meeting. Ames. Ia.

July 1-4—Plant Food Producers of Canada. Manoir Richelieu. Murray Bay. Quebec.

July 20-22—Pac. Northwest Regional Fert. Conf.. Klamath Falls. Ore.

July 21-23—Eighth Annual Beltwide Cotton Mechanization Conference. Little Rock. Ark.

Aug. 11 — Annual Kentucky Fertilizer Conference. Guignol Theater. University of Kentucky. Lexington.

Sept. 8-10 — National Agricultural Chemicals Association. Spring Lake. N. J.

Oct. 6-7—Fifth Annual Convention. Pacific Northwest Plant Food Association. Sun Valley. Ida.

Oct. 18-19—Fertilizer Section. NSC. Chicago. Ill.

Nov. 15-16—California Fertilizer Association. del Coronado Hotel. Coronado. Cal.

AGRICULTURAL CHEMICALS

A Monthly Magazine For the Trade

Cover Photo

Officers and committee heads of NAC at Houston meeting. Center, Paul Mayfield, NAC president, and (clockwise) Howard Grady, chairman of program committee, August Petrus, chairman of arrangements committee, Lea Hitchner, NAC executive secretary, and W. W. Allen, NAC vice-president.

APRIL 1954

Vol. 9 No. 4

In This Issue:

AGRICULTURAL CHEMICALS

Subscription Rates: *One year, United States,* **$3.00**; *Canada and Pan American countries,* **$4.00**; *Foreign,* **$7.00**. *Published monthly on the 15th by Industry Publications, Inc. Wayne E. Dorland, President; Ira P. MacNair, Secretary-Treasurer. Publication office,* 123 *Market Place, Baltimore* 2, *Md. Advertising and editorial office* 175 *Fifth Ave., New York* 10, *New York — Chicago Office,* 333 *N. Michigan Blvd. Advertising rates made known on application. Closing date for copy— 10th of the month preceding month of issue.*

Entered as second-class matter November 4, 1949, at the Post Office at Baltimore, Md., under the Act of March 3, 1879.

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are a formulator's best friend

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this manual tells how to fumigate more effectively

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- ☐ Warehouser
- ☐ Processor
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- ☐ Manufacturer

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- ☐ Cotton Storage
- ☐ Candy
- ☐ Dairy Plants
- ☐ Flour Mills
- ☐ Food Plants
- ☐ Grain Bins
- ☐ Grain Elevators
- ☐ Meat Packing Plants
- ☐ Nursery Soil
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PRIME PRODUCER OF DDT, PESTMASTER METHYL BROMIDE AND OTHER AGRICULTURAL CHEMICALS

Potash Export Association . . .

AFTER more than 15 years of limited operations, the Potash Export Association has recently moved to activate a definite program leading toward development of the export market for surplus potash production. Domestic production of potash has been increasing rapidly in recent years, and while at the present, production is just about adequate for domestic consumption, the Association sees an exportable surplus in the near future.

In 1953, deliveries of domestic potash amounted to 1,879,626 tons K_2O, of which 1,664,242 tons were directed to agricultural uses. Imports for all domestic purposes amounted to 156,898 tons K_2O, a decrease of 26 per cent from the 1952 figure. As is well known, prior to World War I, almost 100 per cent of agricultural potash was imported, but with the abrupt termination of German imports during World War I, we were left deprived of all potash supplies.

Discovery of a potash deposit in Carlsbad, New Mexico, in 1926 was the beginning of the domestic potash industry. The U. S. Potash Co. was the first to enter this field, with production beginning in 1931, followed by the Potash Company of America, International Minerals and Chemical Corp. (known at that time as the Union Potash Chemical Corp.) and the American Potash and Chemical Corp.

Until the mid-40's, domestic production of potash was relatively low, ranging from 300,000 to 800,000 tons K_2O, so that imports were still necessary to meet U. S. agricultural requirements. By 1947, production increased to 936,000 tons, but this still did not meet demand, since fertilizer consumption was increasing even more rapidly. (Since 1940, U. S. fertilizer consumption has increased 100%, from 11,500,000 tons in 1943 to 22,500,000 in 1953, and is expected to increase to about 40,000,000 tons by 1965.)

A major expansion of the potash industry in Carlsbad, in 1952, introduced Duval Sulphur and Potash Co. and Southwest Potash Corp., so that with increased production capacity, improved mining and refining methods, potash production jumped that year to more than 1,300,000 tons K_2O. The New Mexico producers today yield a crude ore output of 7,000,000 tons, and even higher production is expected in the future. A glance at the chart on the next page illustrates the rapid gain in domestic potash production for fertilizer use.

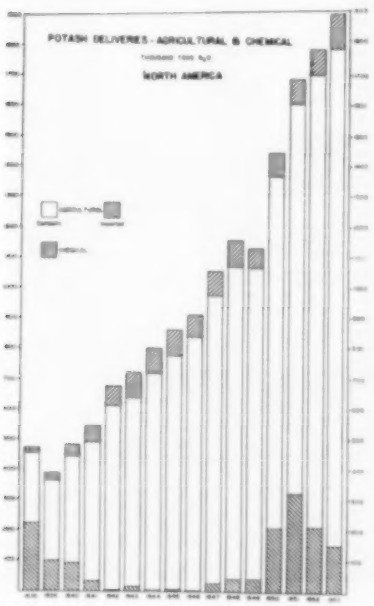
PLANS EXPORT PROGRAM

The U. S. potash producers in 1938 formed the Potash Export Association for the purpose of handling export business in potash, and "to foster sound basic principles of agronomy, through education, production, and assistance to those interested in such services." Present members of the Association are the American Potash & Chemical Corp., International Minerals and Chemical Corp., Potash Company of American, Southwest Potash Corp., and United States Potash Corp.

In December, 1953, the Association initiated plans for an active program of developing the export market; the first step being the appointment of George A. Zeigler as managing director of the Association. The Association is directing its initial efforts in expansion towards the Latin American market, which is as important to the U. S. as all of Europe*, and more important than Asia, Africa and Oceania combined. Mr. Zeigler is now touring South and Central America, for the purpose of analyzing the agricultural problems of the latin American countries. He is scheduled to confer with experiment sta-

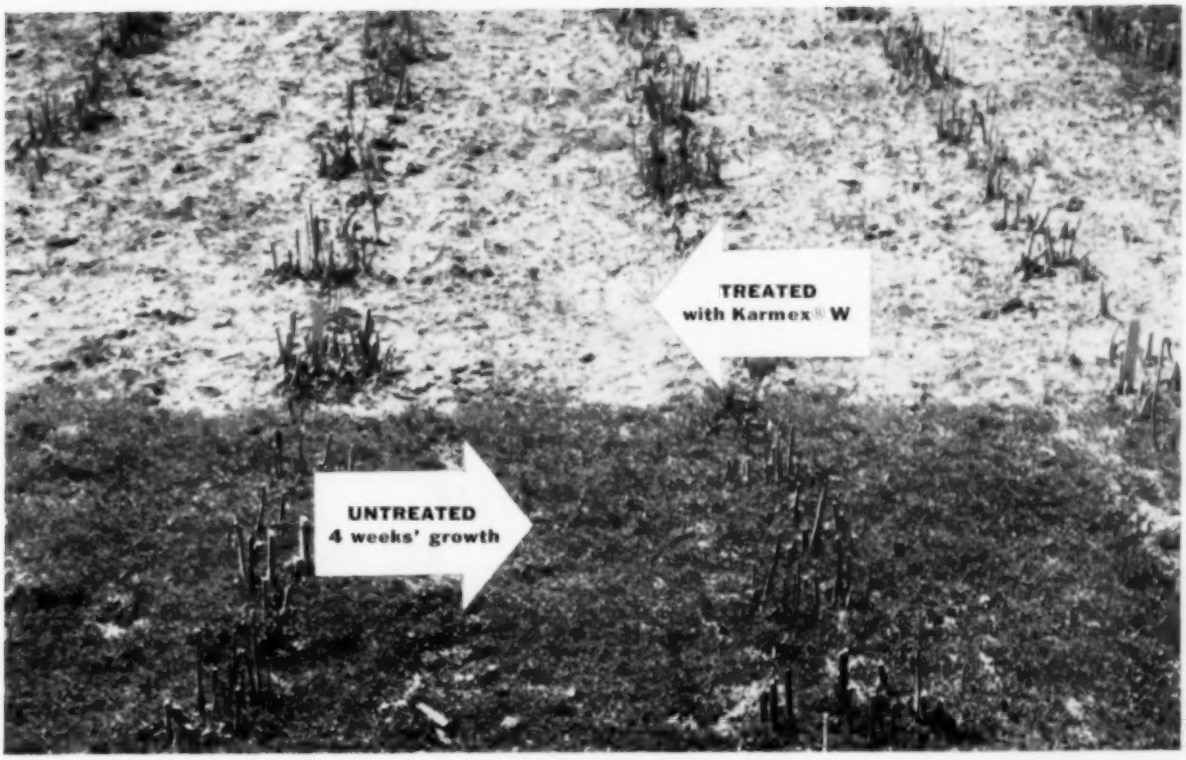
*1953 Report of Milton Eisenhower to the president on United States-Latin American Relations.

(*Continued on Page* 145)



The upper shading of the bars in the chart represents imported agricultural potash, while the white portions of the bar indicate domestic agricultural potash production.

Agricultural potash accounted for 95% of 1953 deliveries, which totaled 1,879,626 tons K_2O. 60% muriate of potash continued to be the most popular material for agricultural purposes.



A new herbicide for a new kind of weed control in crops

Karmex® W

sets a new standard for weed control in asparagus

Herbicide

Outstanding control of weeds at extremely low dosages is the keynote of this new, substituted urea herbicide. As little as one application of 1 to 4 pounds per acre keeps weeds out of established asparagus beds for 6 weeks or more . . . through the entire cutting season.

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"Karmex" W is economical, since only a few pounds per acre are needed to control annual weeds and grasses. With "Karmex" W, growers eliminate costly hand hoeing and top yields are encouraged because the crop doesn't have to compete with weeds for fertilizer, water or sunshine.

"Karmex" W is a wettable powder, ready to mix with water. It is non-flammable, non-volatile, non-corrosive and low in toxicity to humans and animals.

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KARMEX® DL, another member of the urea herbicide family, will be available in limited quantities this year for pre-emergence weed control in certain cotton growing areas.

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from "region-rated" soluble fertilizers

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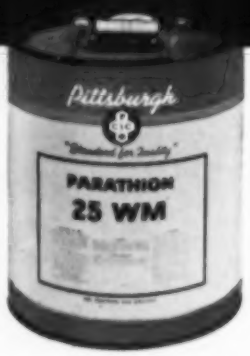
Sell Pittsburgh PARATHION WM



Pittsburgh Parathion WM is probably the most effective, versatile and easy-to-use of all modern organic insecticides. And to back up the ready-made demand for this product, *Pittsburgh* gives you a solid, hard-working sales and promotional program. You get (1) Top uniform quality and on-time deliveries, assured by *Pittsburgh's basic position.* (2) Material that has been field-tested for performance right in your area. (3) A complete advertising program, including farm paper ads, newspaper ad mats, colorful literature and window bulletins. It all adds up to the fact that you can *depend on Pittsburgh* . . . for quality of product and for the promotion that helps you build volume. Write for the complete story on how you can "Sell More in '54" with *Pittsburgh!*

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Technical service is available to help you with your problems.

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Engineered

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PRODUCTION REQUIREMENTS

NO two jobs are exactly alike — that's why Union Special builds a wide variety of bag closing equipment. In the Union Special line you will find machines for closing all sizes and kinds of bags from small textile or paper bags of one pound, or less, up to the largest multiwall paper bags in use today. Whether your production schedule calls for closing just a few bags or for high continuous output, Union Special can supply the equipment to do the work efficiently, economically, dependably!

Coupled with a complete line of equipment is Union Special's vast background of experience and technical know-how that insures customers of getting THE RIGHT MACHINE FOR THE JOB!

Union Special representatives located in all leading industrial centers are qualified by experience and training to give you expert recommendations. Take advantage of the service they offer.

Ask for recommendations. UNION SPECIAL MACHINE CO., 447 North Franklin St., Chicago 10, Illinois.

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CLASS 21800 (left) for fast, economical closing of paper bags. Illustrated is Style 21800 H with 3 N conveyor and 80600 H sewing head for making tape bound closure. Tape is cut off automatically at each end of closure. Sewing head and conveyor adjustable vertically.

CLASS 20300 (above) machines are heavy duty, high production units for closing medium and heavy weight bags. Available with power-driven horizontal conveyor, inclined conveyor, or both; or with conveyor transmission unit only, for plant production line.

STYLE 20100 H (left), is a heavy duty, high production column type machine designed for use with plant conveyor systems. Sewing head is pedal controlled.

DUPLEX MACHINES (right) are designed for closing double bags. The first sewing head closes the inner bag; the second closes either the outer bag alone, or both bags together for extra safety. Also recommended for single closures where continuous operation is a must — operator can instantly switch to other head.

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BAG CLOSING MACHINES

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—Similar to Suprex but with even lower screen residue to permit fastest production time and lowest production cost.

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DUK-PAK Kraft Bags

shed water resist abrasion and stay cleaner!

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2. **DUK-PAK protects your brand name and advertising which appear on the package.**

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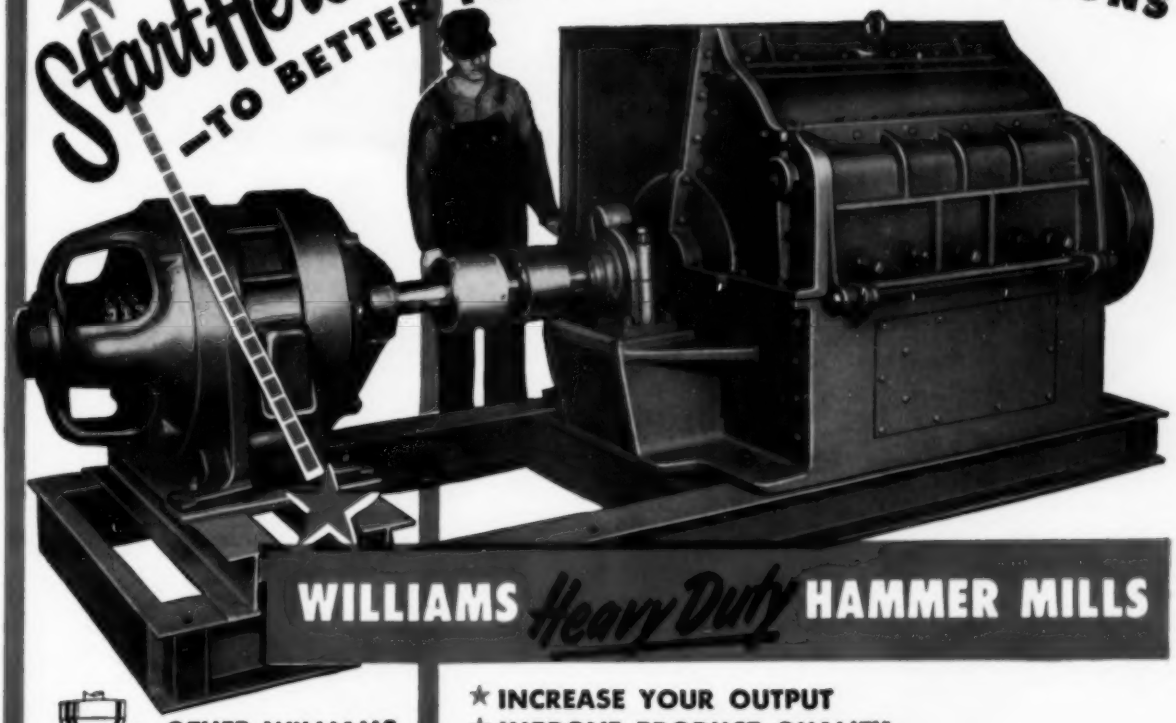
ARKELL and SMITHS the oldest name in paper bags

ARKELL and SMITHS

CANAJOHARIE, N. Y. • WELLSBURG, W.VA. • MOBILE, ALA.

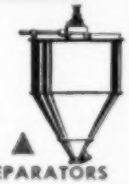
Start Here —TO BETTER YOUR GRINDING OPERATIONS



WILLIAMS *Heavy Duty* HAMMER MILLS

OTHER WILLIAMS EQUIPMENT

ROLLER MILLS
—IMPACT and DRYER MILLS
—for fine grinding to 400 mesh or micron sizes



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—any type; for precision control and high production in fine grinding

VIBRATING SCREENS
1 to 3 decks, —in any size for any job. open or enclosed.

HELIX-SEAL MILLS
—for dust-free grinding, and for wet, sticky, greasy materials.

Also: COMPLETE "Packaged" PLANTS for crushing, grinding, separating.

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★ **IMPROVE PRODUCT QUALITY**
★ **REDUCE YOUR COST-PER-TON**

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Editorial
COMMENTS

SOMEONE down the line at the USDA seems to have pulled a regrettable "skull" in the suggestion advanced last month in an issue of the USDA's *Farm Cost Situation* that farmers might well avoid adding further to farm surpluses by shunning use of fertilizer on acreage-controlled crops. But lest the fertilizer industry rise too strongly in immediate protest, we hasten to add that this poorly phrased advice was apparently simply the old story of one hand in government not knowing what the other was doing, and not any real planned campaign by the USDA to discourage use of fertilizer.

As H. E. Myers of Kansas Agricultural Experiment Station points out in this issue of AGRICULTURAL CHEMICALS (pg. 38), cutting fertilizer usage "would not be sound agricultural economy. . . . Crop surpluses should be dealt with by other methods, possibly by curtailing total production and not by limiting production per acre. . . . Economical production of high quality crops is the justification for the continued use of fertilizer in the face of mounting surplus crops."

If there are still surpluses even after acreage controls have been imposed, the answer may well be that the USDA hasn't gone far enough with its acreage cuts. Further cuts may be indicated, or perhaps as suggested above a limit on "total production," — but certainly not uneconomical, high-cost production by discouraging intelligent use of one of the farmer's most useful tools, — fertilizer.

WHAT are the prospects for insecticide sales in the season just opening? Will a bigger volume of pesticides move this year, — and will materials move at prices that will return a fair margin of profit to each man on the sales line,— the basic producer, formulator, and distributor?

At this early stage of the season the answers to these all-important questions are not yet clear. It is perhaps unfortunate for the agricultural insecticide industry that in recent years its profit potentialities have been so closely tied to the cotton picture. But there is no getting away from the fact that cotton poison bulks large in the insecticide sales picture,—and as the cotton crop goes, so goes the insecticide business.

As the N.A.C. met in Houston last month, cotton planting was just starting in some areas, and should have been starting in others but for the continuing drought that has afflicted some sections of cotton Texas for the past several years. The growing picture in this area is not at all uniform, of course. Some parts are in bad shape,—with subsurface moisture far below normal. In other areas, by contrast, there is nothing wrong that a little early rain could not cure. But there is no denying the fact that growers, and those who supply the growers as well, are worried, for another season of dust storms could be tragic.

Supplies of insecticides have been moving to dealers—and to growers—at a relatively slow rate. Caution in buying is the watchword. But

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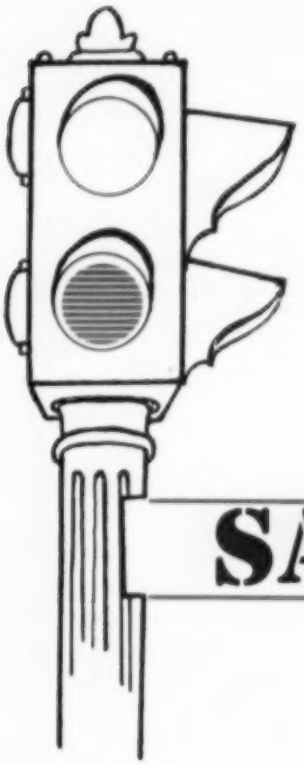

SAFETY in Insecticide Use

By Frank Princi
Kettering Laboratory
University of California

DESPITE the fact that many of the older inorganic insecticides are still in fairly common use, the newer organic insecticides have become of greater economic importance during the past decade, and are now commonly employed in a large variety of formulations. Since new materials are always subject to suspicion, some apprehension and confusion still exists concerning the safe use of these substances. In some instances, this apprehension is due to the lack of information concerning the real hazard which is involved, and in other cases fears have been produced by irresponsible reporting.

Regardless of the actual or inherent danger of any material, lack of understanding of methods of use and ignorance of the intrinsic potentialities of the substance will produce continued fear and confusion. An understanding, however, of the physiologic effects of these materials and of the differences between exposure, hazard and absorption will do much to render common-sense use effective and safe.

Despite the absence of precise knowledge concerning metabolic activity and detoxification mechanisms, continuous studies of workers who have been engaged in the manufacture, formulation and use of the many pesticides have shown that safe handling is possible and that continuous exposure need not necessarily result in deleterious effects when proper precautions are maintained and observed. Harmful physiological effects have been revealed in those instances where excessive absorption has occurred either by reason of ingestion or by careless handling. A study of these records provides information which aids in the understanding of these materials during effective use. These experiences also provide knowledge which is indispensable for the proper understanding of the effects, modes of action, and consequences of the absorption of these materials. This type of information, therefore, provides essential and practical knowledge concerning whether or not illness will be produced; and if it is, what type of reaction will be observed.

Before the hazard of any material can be understood properly however, the difference between exposure and absorption must be understood. *Exposure* means merely that the individual is in an environment in which a harmful or toxic material is known to be present. The definition makes no provision for the form of the material, the quantity of the material, or the likelihood of contact. *Hazard* indicates not only that the material is potentially injurious, but also that it exists in a form and quantity which can be absorbed by the organism and which can produce adverse resuls. *Absorption* indicates that the material actually gets into the body tissues and produces illness. Thus, even though hazard and exposure may exist, proper precautions and proper protection may make absorption unlikely or even impossible. In addition, routine clinical and laboratory observations on individuals who employ these materials will indicate whether or not a significant degree of absorption is taking place and when a dangerous threshold

seems to be approaching, the exposure can be terminated.

In general, the organic insecticides may be divided into the group known as the phosphate insecticides and the group designated as the chlorinated hydrocarbon compounds. The phosphates have been considered to be the most active physiologically and the most easily absorbed. Any of the organic insecticides can be absorbed, however, either by swallowing, by absorption through the skin or by inhalation and absorption through the respiratory tract. Particularly in the case of sprays, absorption through the lungs may occur readily and may produce acute illness since some forms of these materials may be absorbed rather promptly through the lining of the lung.

The finding of blood chemistry changes following the absorption of the phosphate insecticides has aided greatly in the control of the environmental hazards which may be present during the use of these substances. Routine determinations of the blood cholinesterase level have been used to provide advance warnings of impending intoxication and have made it possible to remove workers from exposures before dangerous quantities were absorbed. Because of the availability of this laboratory procedure, several studies have been carried out on persons who were exposed to the phosphate insecticides both during their manufacture and use.

Of particular interest, is the type of information which it has been possible for investigators to obtain during the spraying of these materials. From studies of airplane pilots who had been spraying with parathion, much practical information has been developed. Of one group which were under observation during a summer season, only one man developed symptoms. He complained of dizziness, abdominal cramps, nausea and headaches. However, in no instance where proper precautions were observed did symptoms occur. The use of protective clothing and a full face gas mask connected with an organic vapor and acid gas absorption canister were recommended. It was concluded from this study that the absorption of 5 milligrams of parathion would produce symptoms. Minor physiologic response may also be expected from repeated smaller doses.

Washing Important in Protection

REGARDLESS of the method of application, however, whether by airplane spray or by hand spray, the important consideration is to prevent contact of the individual with the material. When contact does occur accidentally and in spite of proper safeguards, the material should be removed from the skin by washing as quickly as possible. During most spraying operations, it should be possible to avoid inhalation of the materials by proper methods of application. When any danger of inhalation exists, however, the hazard can be eliminated by the use of adequate respirators and protective clothing.

It has been shown by some investigators that the most serious occupational exposure in relation to the phosphate insecticides is to be found in the mid-season hand application of the materials when the cover crop is high and when there is an opportunity for the clothing to become wet. It is significant that the data obtained during studies of this type of application revealed that air sampling for the determination of the atmospheric concentration of the insecticide was very poorly related to the worker's exposure. It seems logical to suppose therefore that absorption occurred not through inhalation but through skin contact. Consequently in some operations, it must be remembered that the opportunity for skin contact and absorption may exceed the likelihood of inhalation or ingestion.

Useful as the cholinesterase method has been proved to be in the understanding of phosphate insecticide hazard and toxicity, its greatest field of importance is in that of diagnosis. When doubtful cases occur, the diagnosis can be confirmed by the finding of a reduced cholinesterase level in the blood. No laboratory method of follow-up will, however, replace the use of adequate precautions and proper clinical observations of the individuals who are exposed to the material. Even when doubtful symptoms occur during the application of these substances, it is recommended that the exposure be terminated until a proper diagnosis can be made.

In the case of the chlorinated hydrocarbon insecticides, there is no laboratory method which will aid either in measuring the amount of absorption of the material or in diagnosis. Certain pertinent information is available, however, concerning the hazard which they offer. At the present time at least, there is no evidence to indicate that absorption of these compounds will result in measurable changes in blood chemistry or blood elements. Whatever metabolites are excreted through the urine have not yet been identified completely. Liver function tests will be positive when intoxication is apparent, but they are usually misleading when one attempts to estimate the degree of exposure or the amount of absorption which may have occurred. The obvious gaps in our knowledge concerning metabolism and individual susceptibility therefore make it particularly difficult to study these compounds from the point of view of comparison of dose and effect.

Adequate Precautionary Measures Allow Safe Use of Even the Highly Toxic Pesticides . . . Only Under Conditions of Careless Handling is Serious Hazard Normally Encountered.

Despite these handicaps however, experience in the use of the chlorinated hydrocarbon insecticides has made it possible to understand the hazards of use with a reasonable degree of accuracy. It is known that these materials are absorbed readily when they are in the form of sprays or emulsions, but they are absorbed less rapidly when they are in the forms of dusts or powders. This difference in absorption is probably due to the fact that particles of the chlorinated hydrocarbons have the property of adhering together so that most of the substance does not reach the terminal portion of the lung. This physical property, however, does not insure safety of inhalation since any of the materials in question may be coughed up and swallowed. Most persons do swallow the material which they cough up from the lungs (either consciously or inadvertently), so that absorption occurs through the gastro-intestinal tract rather than through the lungs. These insecticides may also be swallowed either intentionally or accidentally, but such instances are uncommon and need not present a hazard in terms of ordinary use.

Avoid Absorption Through Skin

ABSORPTION through the skin is the most common hazard and presents perhaps the greatest danger in ordinary use. This danger would not exist if users were particularly careful to prevent accumulation of the material on the skin or if they washed off the material as soon as it came into direct contact with the skin. As with all insecticides, protective clothing should be employed when the material is used either in the field or during mixing operations. In the case of the chlorinated hydrocarbon insecticides, however, protective clothing does not mean a material which is impervious to liquids. The term, protective clothing, merely signifies that clean coveralls or other garments should be worn daily. When any insecticide is spilled on the clothing, the clothing should be removed and replaced. If materials are spilled directly on the skin, soap and water are sufficient to remove them. But most important of all is the fact that spilled materials will not be absorbed instantaneously. A certain period of time is required for such absorption to take place. Therefore, there is no reason for panic or alarm when spilling does occur. Washing should be done within a reasonable length of time and the material should not be allowed to remain on the skin all day.

Regardless of the route of absorption, the organic insecticides will produce a fairly definite type of illness. Absorption of the organic phosphates will result in central nervous system disorders. These will produce symptoms of headache, nausea, blurring of vision, irritability, excitability and eventually convulsions. The most important consequence and the greatest hazard to life in the absorption of the organic phosphates is the development of a wet lung, with subsequent suffocation. In the use of the organic phosphates, it is recommended that respirators be worn, that protective clothing be employed, and that the material never be handled with the bare hands.

Most of the chlorinated hydrocarbon insecticides can be used safely without respirators provided certain precautions are taken and maintained. These precautions include care in mixing and spraying so that none of the material is inhaled. In airplane spraying, the pilot should not fly through a swath that has just been laid down. In hand spraying, spraying should be done downwind and not upwind. Care should be taken not to walk through areas which have already been sprayed, particularly through vegetation which is wet with the spray. In mixing, the material should be poured slowly and not agitated so that clouds of dust or spray are given off. Formulations should never be mixed by hand. If care is taken that the material is not inhaled (and this hazard need not be present), the use of respirators should not be essential.

Acute intoxication by the chlorinated hydrocarbon insecticides will result in nervousness, hyperexcitability and convulsions. If any of these symptoms are seen, the patient should consult a doctor immediately. Self treatment and delay are unwise under any situation and they may be particularly dangerous when organic insecticides are involved. When any symptoms occur, it is well to keep in mind that there has been an exposure to an organic insecticide; it should also be remembered, however, that other diseases which are not related to the material in use may occur and that many of the symptoms of these other diseases are similar to those which are produced by the organic insecticides.

Chronic Toxicity Hazard Not Severe

MUCH has been said about the dangers of chronic absorption or rather slow absorption over a relatively long period of time. Actual use of these materials has not demonstrated that this is a severely critical danger. In the case of the phosphates, excess exposure will ordinarily have been recognized. With continued exposure to the chlorinated hydrocarbon insecticides, nervousness and irritability will occur and these will be apparent to the patient. Under these circumstances, the affected individual should consult a doctor immediately. Other symptoms may be loss of weight, loss of appetite, and inability to sleep. Regardless of whether these symptoms are produced by the use of the materials in question, any individual suffering from these disabilities should consult his physician. (Medical attention is particularly important in view of the fact that similar symptoms may be produced by fatigue and as a consequence of overindulgence in alcoholic beverages.) Later, as continued absorption develops, the individual may become lethargic and confused. Regardless of the cause of the symptoms, it is essential that the person consult his own physician as soon as possible.

In common with most other occupational hazards, the main route of entry into the body of these chemicals during occupational exposure is the respiratory tract. The amount of material which will be absorbed by this route is dependent upon a large number of physical and

chemical factors. Retention of the material in the lungs will depend upon the particle size of the material, whether it is a fog, dust, mist or vapor. The concentration of the material in the inhaled air will be of the utmost importance and the nature of the vehicle will usually influence the rate of absorption. With all these factors in mind, observation during the manufacture and use of these compounds indicates that this type of hazard can be reduced greatly. Another factor in the relatively infrequent presence of respiratory hazards is the characteristic of most of the chlorinated hydrocarbons, either in solution or as a powder, of clinging to the surface with which they first come into contact. For this reason it is unlikely that they will form a dust when they are exposed to air movements after they have been deposited on any surface.

Absorption is the Most Common Hazard, Thus Protection of the Skin is Imperative. Most Important is to Prevent Contact of the Individual with the Toxic Material. When Accidental Contact Does Occur, the Toxicant Should be Removed from the Skin Immediately by Washing.

Absorption by other routes has been a more serious problem and greater precautions are necessary to prevent excess absorption and subsequent illness. Penetration of the intact skin has been and will continue to be the most important occupational hazard wherever proper care is not maintained. Although the type of vehicle which is employed will modify the rate of skin absorption, the chlorinated hydrocarbon insecticides will be absorbed through the skin regardless of their physical form, although absorption through the palms of the hands and the soles of the feet will be less than through the hairy areas of the skin where sebaceous glands and hair follicles are found.

Because of these considerations, protection of the skin is imperative and compromises should not be allowed. The hands and wrists should be protected in any operation where there is a possibility of contact with the chemical. Material which is spilled on the skin should be washed off with soap and water. Contaminated clothing should be removed and not worn again until it has been washed. These simple common-sense precautions will result in safer working conditions and the avoidance of illness even when exposure exists to large quantities of insecticides.

Although a third portal of entry of toxic materials into the body is the mouth, this route is not an ordinary occupational hazard. Most poisonings by ingestion have occurred through suicidal intent or by accidental ingestion. The latter have been common particularly among those individuals who have developed the dangerous habit of atttempting to clear obstructions in spray nozzles by sucking them with the mouth. From a more practical point of view, however, it should not be overlooked that material which has been allowed to remain on the hands can be ingested when food is eaten and that coughing will result in the ingestion of sputum which may be laden with the insecticidal materials. Rare as these instances may be, they should not escape consideration in any discussion of occupational hazards.

A Program for Safety in Use

WHEN all the factors which are present in an environmental exposure have been considered, adequate precautionary measures can be instituted which will result in safety of use and decreased apprehension among workers. No amount of mandatory instruction will be effective, however, unless the worker understands the hazards of the operation and the reason for observance of safety rules. For this reason, worker and supervisor alike must receive adequate instruction concerning the characteristics of the materials to which they are exposed and the reasons for the institution of precautionary measures. When the individual is able to receive information in a rational fashion rather than in the form of rumors, he will work with greater self confidence and greater safety.

Any explanation of anticipated symptoms should include the information that the earliest findings do not come on suddenly, and that during continued exposure the illness progresses slowly. More important even is the fact that recovery is rapid and without the development of permanent injury. Even in the presence of sudden overdosages when nausea and vomiting occur, these two will remit spontaneously when the exposure ceases. Finally, although convulsions will result from the absorption of these large quantities, this circumstance is unlikely during ordinary use even under conditions of gross carelessness.

A review of many years of experience shows that true intoxications during the manufacture and use of modern agricultural insecticides are relatively infrequent and that even serious exposures can be controlled by intelligent handling. In fact, only under conditions of careless handling will harmful consequences eventuate and even then recovery from intoxication is usually rapid and uneventful. Intelligent understanding of the actions and potentialities of any of the insecticidal materials which are now in use will make it possible to protect man both from insects and the chemicals which are used to control them.

Regardless of the exposure or hazards which may exist in the use of any potentially toxic material, certain general rules are of value if they are applied intelligently to workers exposed during the application of insecticides. These rules are as follows:

(*Turn to Page* 133)

WHAT'S AHEAD

IN the development of this topic some may expect me to dwell on the increasing need for food and fiber to sustain the increasing population of the world, which today has reached a total in excess of 2½ billion people. In the United States the increase is at the rate of four people per minute, which is expected to result in a total population of about 190,000,000 by 1975. If the world population were to increase at the same rate, the total in 1975 would be about 2,865,000,000. The population trend is a significant factor in our look ahead. Of even greater significance is the dietary level of people as they exist in the world today. It has been estimated that in pre-World War II days 69.4 percent of the world population received an average of 2700 calories or less of food energy per day, while 77.9 percent received 30 grams or less per day of animal proteins. It has been estimated also that on the basis of the supply of world grain, only 920,000,000 people could be supported on the North American standard of living. This number is about 40 percent of the people now populating the world. On the Asiatic standard, 2,954,000,000 people could be supported. This figure is just a little larger than the above estimate of world population for 1975. The Americans and certain other people of the world have no desire to witness a gradual decline in the standard of living to a level no higher than that experienced in large areas of the world today.

The population in relation to the potential food supply poses a serious question that no one should brush off lightly. It does have a relationship to the future of the fertilizer industry in the United States. However, it also is a political problem involving world trade etc.

No attempt is being made to minimize the relationship of the fertilizer industry to the sociological problems of the world. Yet little can be done below the level of international politics.

The tremendous expansion in the productive capacity of the fertilizer industry of the United States resulted from the immediate demand for fertilizer materials. The prospect of a continued high demand in the future added confidence to the expansion program, but was not the cause of it. The trend in population is only one factor, probably a minor one, indicating a continuing high demand for the products of the expansion program. Of much greater significance is the demonstrated economic need at present economic and population levels for the repeated addition of greater quantities of fertilizer materials, both in areas where fertilizers are used sparingly and where they are used abundantly.

It is well that the fertilizer industry did not justify its increased capacity in order to solve the theoretical short food supply of 1975. Today with the populaion far short of that expected in 1975 and despite people being hungry in many parts of the world, the nation is face to face with surplus grain and fiber. It has been estimated that the use of fertilizer and lime contributes about 25 per cent to the total agricultural production in the United States. Additional fertilizer use, where needed, will increase production and therefore may contribute to the surplus problem. It is not wise to negate the immediate surplus problem by emphasizing the need for increased quantities of food and fiber in the future. The continued use of a contributor to the surplus problem must be justified in terms of the conditions as they exist today. Economical production of high quality crops is the justification for the continued use of fertilizers in face of mounting surplus crops. To reduce the surplus by eliminating the use of fertilizers would not be sound agricultural economy nor in the best interest of a widespread, sound rural economy. Crop surpluses should be dealt with by other methods, possibly by curtailing total production and not by limiting production per acre. The latter usually results in less economical production.

The past development of the fertilizer industry has been the result of the application of research in manufacturing technology and in fertilizer use. The future development will be dependent upon the application of additional research results. Research has been the basis for all material progress in all areas of human endeavor. Research is interpreted to mean a search for new knowledge. The fertilizer industry is based on research. Prior to the nineteenth century all soil improvement resulted from the use of natural materials such as animal manure, legumes, bond, nitrate of soda, guano, etc. Somewhat over 100 years ago von Liebig acidified insoluble phosphates. Lawes started the synthetic fertilizer industry when he started the manufacture and sale of superphosphate. The next major step was the discovery of methods for the making of nitrogen compounds from atmospheric nitrogen. The methods of synthetic nitrogen fixation have been improved greatly. New phosphorus carriers were developed, giving us triple superphosphate, metaphosphates, ammonium phosphates, nitraphosphates, etc. Domestic sources of potassium were discovered and improved methods of refining the crude ore were developed.

Role of Research in Future Outlook

RESEARCH in fertilizer use gave information on the relative value of different carriers, proper placement, rate of application, crop re-

sponse, the relationship of fertilizer use to the quality of crops, and economic aspects of fertilizer use. The agronomic and economic research combined with the research in the technology of the manufacture of fertilizer materials provided the basis for the great expansion in production and use of fertilizer.

Changes in the fertilizer industry in the last few years have been very great. As an example, ammonium nitrate and anhydrous ammonia, almost unknown as fertilizer nitrogen carriers 15 years ago, now dominate the nitrogen industry. Methods of manufacture have improved greatly. These and other changes resulted from the application of research. The rate of change has been proportional in a general way to the amount of effort put forth in the research program.

If research of the same magnitude is continued in the future, it is expected confidently that the improvements will be as great in the future as they have been in the past. If the amount of research is stepped up, it should be anticipated that the changes will be even more rapid in the future. The fertilizer industry should be expected to carry a large part of the research load in the future. It has an obligation to see that an appreciable portion of its profits are put into research designed to improve the efficiency of its product as used by the farmer.

The fertilizer industry should support basic or fundamental research in areas relating to the industry. By basic or fundamental is meant research designed to elucidate the laws of nature. Here is an industry with a firm footing in basic research. The industry as we know it today could not have developed unless someone had looked for, found, and characterized the elements, especially nitrogen, phosphorus and potassium. Someone had to determine the laws pertaining to the behavior of gases before nitrogen could be fixed from the air. Catalytic action had to be understood. The law of mass action had to be understood before various compounds could be manufactured from rock phosphate. The need for basic research is in three fields: (1) in the area relating to technology; (2) in those little understood boundaries where soil chemistry, plant nutrition, and plant physiology meet, to the end that we may be able to calculate the complete nutrient requirements of the soil for the economical production of high quality crops; and (3) in the realm of the relation of fertilizer balance and imbalance to the quality of crops as indicated by chemical assay checked against animal response. The fertilizer industry has a significant responsibility to learn how to put soil fertility and plant nutrition together most effectively for the production of high quality food.

Research in the field of fertilizer manufacturing techniques is going ahead to an extent never before witnessed. Near revolutionary changes in the manufacturing process may be expected in the future. New and better equipment with labor saving devices will come with research. The development of the nitra-phosphates; the electric furnace process in making phosphorus and phosphoric acid; improved methods of nitrogen fixation; studies on the blending of anhydrous ammonia, ammonium nitrate, triple superphosphate and muriate of potash; development of liquid fertilizers; and efforts to develop a low cost process for the manufacture of nitric acid are only a few examples of technologies on the horizon that may have marked effects on the fertilizer industry.

One of the most obvious future adjustments will be the lowering of the price of fertilizer materials. Improved technology will tend to bring this about. But of even greater importance is the fact that only now is supply beginning to catch up with the demand which was such that fertilizers were sold with little sales effort. Competition may further depress the price.

Dealer and Sales Program

THE future will present to the industry a greatly enlarged opportunity to be of service to the consuming public. If the industry accepts the challenge, the United States should continue to enjoy economical production of high quality food in abundance. The continued improvement in the soil testing program should be an important factor in the ability of the industry to be of service to the farmers. As the soil tests improve, the dealers and salesmen will be able to fill soil prescriptions as needed. The dealer should help the farmer under-

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for the

Fertilizer Industry

*By H. E. Myers**
Kansas Agricultural Exp. Sta.
Manhattan, Kansas

stand his fertilizer problems much more thoroughly than he does now. This means a more enlightened dealer and one who sells his product for what it is in relation to the farmer's need. The dealers render a service by selling only those nutrients which are needed. To sell lime through the fertilizer bag to correct an acid residue in the soil resulting from fertilizer is an expensive way to apply lime. Furthermore, to add calcium sulfate to all soils because some soils need sulfur is not rendering the high level of public service which should be expected of a responsible industry.

Every manufacturer should produce a quality product—a product in which he himself will take pride. In the future, quality of product should play an even greater part in the sales program than it does today.

The future offers an opportunity to expand the consumption of fertilizers by intensifying the sales program in those areas where crop response and economic studies show a possibility for an expanded market. This tremendous possibility for greatly enlarged sales is on the basis of information available today. Fertilizer use should continue to expand. In only a few instances, involving a few crops and small areas, has the economic ceiling of use been reached. If all farmers used 100 per cent of the fertilizer amounts recommended by the Land Grant Colleges and the United States Department of Agriculture, the fertilizer industry would not have sufficient plant capacity to meet the need even after all the present expansion program is completed.

The USDA-Land Grant College-Industry committee on efficient use of fertilizer and lime is, in part at least, a recognition of the fact that farmers are not using fertilizer to the level of their economic feasibility. This committee should be continued until the situation is reasonably well corrected.

The future of the industry is contingent on how well farmers follow the fertilizer recommendations of their experiment stations and the United States Department of Agriculture. Future recommendations should include economic and farm management information to a greater extent than has been true in the past. Recognition must be given the fact that fertilizers are an indispensable part of various management factors necessary for high yields, but that they do not eliminate the need for other good soil management practices.

Higher Analysis Materials

IT is anticipated that there will be a continuing trend toward higher analysis fertilizer materials. Much progress has been made in this direction. The national average in 1951-52 was a total plant food content of 24.86 per cent. Material carrying 100 per cent plant food content does not appear to be outside the realm of possibility. The TVA is studying ammonium metaphosphate carrying about 20 per cent nitrogen and 80 per cent available phosphoric acid. If such a high analysis material is actually realized, it may give added impetus to the change in the method of expressing nutrient content of fertilizers.

Land Grant Colleges and USDA personnel have long advocated high analysis materials. Industry has moved slowly in accepting the recommendation, partly for economic reasons. It is interesting to note that all industry people, polled recently on the question, favored higher analysis material. Only one person cautioned that we might be overdoing the high analysis trend. He was a USDA man.

There are several factors which make still higher analyses appear reasonable. The greatly increased triple superphosphate capacity, and the recovery of uranium during the manufacturing process, adds to the supply of a high analysis component of the mixed fertilizer, with the uranium justifying some of the production cost. Manufacturers of normal superphosphate can use liquid phosphoric acid in their standard equipment for making high-analysis phosphate material. This may be a decided advantage over the purchase of such material. It constitutes an important reason why the trend to higher analysis material is expected to continue. The tremendous increase in the quantity of high analysis nitrogen carriers, urea, anhydrous ammonia, ammonium nitrate, and nitrogen solutions offers possibilities of still higher analyses of mixed fertilizers whenever the technical problems relating to their use have been solved. The increased use of ammonium phosphates will add greatly to an elevation of the analysis. Likewise, nitrophosphates, if used, extensively—possibly with potassium added—will up the average analysis over that which exists today.

Some low analysis materials will be with us for a long time, but the squeeze is on. Low analysis superphosphate, both as a straight good material and as a constituent of mixed fertilizer, will find its area within a small radius of the producing plant. Nitrate of soda won't be found very far from the dock onto which it is unloaded.

Plant Nutrients and Liquid Products

SECONDARY and trace nutrients will continue to increase in importance. The continued use of N, P, K and lime, with resulting high yields, will eventually result in a depletion of the soil of other nutrients. The trend toward higher analysis fertilizer materials is also a factor in this regard. Magnesium, boron, copper, manganese, and zinc are the nutrients which will be of greatest interest to the industry.

The future should witness a marked increase in the use of liquid fertilizers. There has been a definite trend in this direction. It is hard to answer affirmatively a question as logical as this: Should one process a liquid into a solid when the solid has no specific virtue? This applies especially to anhydrous ammonia and various nitrogen liquids, but also has application for mixed fertilizers as well.

Bulk Spreading Considerations

BULK spreading of fertilizers is developing rapidly and may become the chief method for fertilizer distribution. If bulk spreading does become a principal method of fertilizer distribution, it will be a case of economy and ease of distribution offset-

ting efficient use of fertilizers by the crop. As the trend proceeds toward bulk spreading, are we throwing out of the window all of the fine work relating to placement? Is bulk spreading coming in because our present fertilizer placement machines are inadequate or too laborious and costly?

Bulk spreading offers a number of interesting possibilities. Custom mixing is a possibility. If custom mixing is practiced, the need for mixed fertilizers as we know them today will greatly diminish. Custom blending to a prescription based on soil tests would appear to offer considerable economy. Maybe even custom mixing and blending will not be needed. Fertilizer distribution machines designed to apply simultaneously as many as three materials at different rates are within the realm of possibility. It should be possible to set a dial indicating the amount per acre to be applied of each plant nutrient. Such a development could have a marked effect on the mixed fertilizer industry. After all, why a mixed fertilizer of a given grade? Mixing does not increase the value of the individual fertilizer constituents. A given fertilizer grade probably would not fill the prescription for a soil. Mixing adds to the cost but also adds to the convenience of applying one instead of three different materials. Fertilizer distribution during slack fertilizer seasons, which bulk spreading would encourage, would be advantageous and should result in lower total cost of fertilization. In order to get many farmers to fertilize out of season, the dealers will have to price the product in such a manner as to make it profitable to do so. The industry people object to two prices during the season. They argue that if the farmer is quoted a low price to encourage him to buy early, he will expect to buy at the same price at the normal time of purchase. If the industry people wish to abide by the principle of only one price per season, then they should start expanding their storage capacity. Without a price incentive, out of season usage will not make much headway. A price incentive for off season distribution of fertilizer materials will come in the future.

Bulk spreading will not replace row application for "starter fertilizers" applied at seeding time. A reduction in the cost of machines for fertilizer placement should come in the future. The high cost of a combination small grain and fertilizer drill, as an example, is such as to reduce greatly a farmer's desire to purchase the equipment.

Bulk spreading is adapted when large quantities of fertilizer are used and where the practice is to fertilize the soil once for several crops in contrast to applications for each of several crops. Long term investment in soil fertility is in general a sound investment for phosphorus and potassium. If a farmer has surplus funds of his own, or can arrange for the necessary credit, the investment in fertility is logical. When surplus funds lessen and credit tightens, the interest in long term fertilization programs will slacken.

The future will witness a much greater portion of the total fertilizer supply being sold to consumers as straight goods and as chemically manufactured mixed fertilizers. As the soil testing program improves, and as prescription fertilization becomes a reality, the efficiency and economy of straight goods for blending to a prescription will become more evident to the consumer. Chemically, mixed goods such as nitrophosphates and ammonium phosphates should be used in increasing amounts.

Granulation of fertilizer materials has come to stay. That the agronomist cannot show a clear cut benefit for the granulated product will have no influence in the future acceptance of granulation. The pleasure of handling granulated, in contrast to powdery, material is of sufficient advantage to create a strong demand for pelleted fertilizers. Granulation is not as important where bulk handling and custom application is practiced, as it is with fertilizers used by individual farmers. However, granulation will certainly facilitate rapid and uniform blending as bulk lots of individual materials are passed out of storage bins through a mixer for delivery into a truck or other conveyance.

Pasture Fertilization Program

THE future should witness a greatly increased use of fertilizers on pastures and forage crops, and in general on crops used for runoff and erosion control. Pasture improvement is in general, a figure of speech so far as actual accomplishment is concerned. An adequate pasture fertilization program will do much to make pasture improvement a reality. The fertilization plan to be successful must be a part of sound livestock and grass management programs. Provision should be made to harvest and store the surplus high quality feed during periods of peak production. Pasture fertilization will do much toward reducing the surplus of grain crops, stabilizing agriculture, and reducing runoff and erosion. Grass areas were plowed originally because grass was low in productivity compared to cash crops. A return to grass will be of short duration unless its productivity is greatly enhanced. An adequate nitrogen fertilization program for grass will reduce the need for legumes in the pasture mixture and thereby reduce or nearly eliminate the bloat hazard which restricts the use of legumes in the pasture program.

Nitrogen fertilization and the use of urea as a commercial feed supplement may reduce somewhat the already inadequate acreage of strong legumes, but not seriously. Protein feeds have been so deficient generally in the livestock program, that it appears that the use of nitrogen fertilizer for the production of high protein feeds and urea as a nitrogen feed supplement should merely contribute to an improved level of animal nutrition without greatly reducing the dependence on strong legumes. Strong, productive legumes are here to stay.

In the future we should expect the plant breeders to give increased attention to the problem of develop-

(*Continued on Page* 138)

Role of Chemicals in the future of Insect Control

THE problems of entomology and of chemical control become more complex with time. Although we have no direct source of information on sales or usage of insecticides, figures for production of insecticides are available. These have been charted (facing page) for the period 1934 - 1952. The use of pounds as a common denominator is perhaps a little misleading to the extent that dosage for various materials differs, and the general trend has been toward lower dosage of materials of higher potency. Insecticidally treated acreage has probably increased even more dramatically than this curve indicates. While it would also be possible to express this history in dollar value, working from such data would be more complex because of variation in prices from year to year.

Production for a given year differs from consumption by the amount of carryover and export, but in the long range, the manufactured amount is roughly indicative of trend. Sizeable variations in production, such as occurred in 1948 and 1952, reflect decreased usage, but the data probably magnify this decrease because holdover stocks were probably being used during these years, making actual usage higher than production. The reverse situation probably pertained in peak production years such as 1947 and 1951 when not all insecticides produced were actually used. It should also be remembered that this period began in depression times and is being continued in boom times. Nevertheless, the steepness of the upward trend of the curve, which would be accentuated on an arithmetic rather than logarithmic scale, indicates a phenomenal rise in total insecticide usage over the past twenty years.

The chart illustrates the rapid increase in production of synthetic organics and a corresponding decline for the inorganics and botanicals. The rapid increase for the synthetic organics would appear even greater if plotted in terms of acre applications or constant dollar values. The generally expected more severe decline of inorganics and botanicals, in recent years, appears to have been offset by the popular upsurge in usage of all insecticides. However, it appears doubtful that insecticides in these latter categories will return to a period of increasing usage.

The factors which control the use of insecticides are pest insect populations, crop value, effectiveness of the material, cost, hazards attendant with use, and phytotoxicity. The use of chemicals will increase in direct proportion to the first three factors and inversely with the latter three. Any one of these six factors can eliminate the use of an insecticide in a particular situation and all six must be favorable for extended usage. Faced with the difficult problem of our hypothetical extension of the lines of our chart into the future, we must try to analyze the future conditions with reference to each of these six factors individually.

Insect Population

INSECT populations are not likely to be generally decreased. Modern methods of rapid transportation will eventually make most insect pests cosmopolitan in distribution within their climatic limitations. This means that each crop will probably be attacked by a greater number of different insect pests than it has been in the past. As this happens, we may expect a greater demand for insecticides which are toxic to a wide range of different species. Admittedly, most toxicologists are forecasting an ever-increasing number of insecticides with specificity of action. Some of the newer and better phosphate materials, however, have shown ability to control a broad spectrum of insect pests. It is inconceivable that a universal insecticide is either possible or desirable. It seems logical to assume that we may actually increase the number of insecticides in commercial usage, and, at the same time, increase the range of application of each individual material.

Agriculture, which once was a way of subsistence, rather than a cash business, is tending toward greater efficiency and concentration of individual crops, a condition which has always aggravated insect problems. Insect populations on crops extending for miles and in the same general stage of development can quickly reach catastrophic proportions requiring prompt and effective chemical control for their supression.

Not only must we be prepared to meet a greater variety and concentration of insect populations, but

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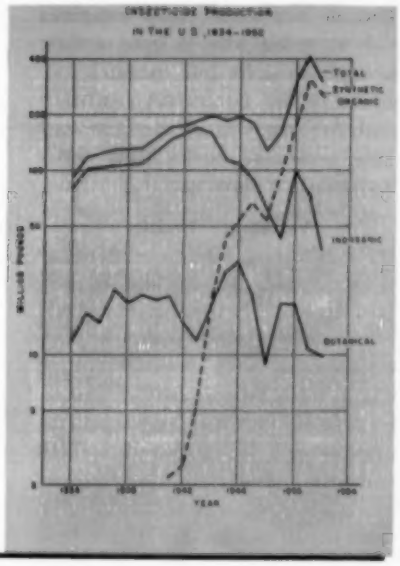
Before Annual Meeting of Entomological Society of America, Los Angeles, Dec., 1953



also we have lately been faced with a dangerous new kind of population, namely the resistant insect. It has become increasingly clear that the ability to develop a resistance to certain insecticides is widespread among insect species. It has become equally apparent that the development of resistance is likely to be even more specific than susceptibility. Many insects which have long been controlled effectively by DDT have developed no apparent resistance. The house fly which quickly became resistant to DDT and other chlorinated insecticides has shown relatively little resistance to pyrethrum and the phosphate materials. These considerations lead us definitely away from the hypothesis of general insecticides and to the reluctant conclusion that continued effective control of expanding insect populations must depend on an endless development of new insecticides of greater variety and specification.

Crop Value

CROP value in absolute dollars has little meaning, since value is relative to labor costs, land values, and general economic conditions. Thus, the sale of insecticides is part of a cycle of farm economy and subject to the usual economic laws.

Perhaps the most important trend in crop value is the tendency of the public to demand ever higher quality in farm products, with the result that the farmer is forced into better insect control methods in order to meet competition.

Since many crops cannot be produced at all without the application of insecticides, there is a continuing market in depression times and a greatly expanded market in boom times. This, of course keeps manufacturers of agricultural chemicals in business and makes the agricultural chemical industry a successful competitor with other types of chemical industry for the stockholders' investment dollar.

The real value of an agricultural crop is proportionate to its usefulness in feeding and clothing the population. As the population of the world increases, the demand for and total value of crops also increases. Half the world is presently underfed, ill-housed, poorly clothed, and suffering from insect-borne diseases. Regardless of the economic cycle, insecticide usage must increase not only to keep up with the increasing population, but also as we learn now to provide and distribute our agricultural produce to the undeveloped areas.

Insecticide Effectiveness

IT might be expected that as more effective insecticides are developed, less of them would be required. During the past ten years, much the greatest advance in effectiveness has occurred, and quite the opposite has happened. As the amount of insecticide required to dis-infest an acre of crops goes down, the number of acres that can be profitably treated increases proportionately. In addition, whole new crops complexes become markets for insecticides. Phosphate insecticides have made it economically feasible to spray for the control of greenbug during the past three years in the Midwest grain belt. Hundreds of square miles of forests are being sprayed annually, with costs as low as a dollar an acre. The European corn borer, grasshoppers and especially mosquitos have supplied large markets for insecticides that hardly existed ten years ago.

As the base of usefulness has been broadened by increased effectiveness, so also have improved application methods brought about a wider usage. Aerosol bombs, smoke dispensers, and thermal diffusers have provided new weapons for more effective use of the new ammunition. Not only in the control of pest and disease carrying insects, but also in the field and forest, mist blowers, the airplane, and helicopter and particularly power sprayers have served to multiply the use of insecticides by dividing the cost of their application. Insect proofing of grain bags, seed treatments, pelletized insecticides, insecticide-fertilizer combinations, self-renewable insecticidal surface coatings, and other techniques have further broadened the base of chemical control.

The more effective materials and applicators have made possible effective tax-supported eradication and supression programs. The highly satisfactory mosquito abatement districts of the Western states, the Federal Government supported locust campaigns in foreign countries, and the more efficient eradication campaigns that can be used against a newly introduced pest, all add up

to inevitably increased usage of insecticides as a result of their greater effectiveness.

Cost

THE factors of effectiveness and cost can hardly be considered separately. It has been shown above that increased effectiveness lowers applied cost per acre and results in a much greater total usage. The selling price of a chemical is a balance between the manufacturer's cost of development, production and selling, and the grower's ability to pay. The cost of developing a new insecticide is staggering. The years of research and testing, the cost of toxicological evaluations, residue determinations, production and sales development, quickly mount into hundreds of thousands of dollars. If the costs of fruitless research, administrative overhead, and amortization of capital in plant construction are added to these more direct costs, the figure goes far higher. Industry is naturally anxious to reduce these costs. Some of the problems faced by industry that add to the cost will be discussed later. Nevetheless, during the first two or three years that a chemical is marketed it must be sold at a high price. During this period, when the selling price is highest, the manufacturer almost always loses money. A chemical that may eventually be manufactured at a level of ten million pounds a year and profitably formulated, packaged, distributed and sold for $1.00 a pound, is likely to cost $5.00 a pound for the first ten thousand pounds produced. The great effectiveness of the chemical may enable the manufacturer to sell his first ten thousand pounds for as much as $2.50 a pound. This, of course, results in the regrettable situation of the manufacturer's having to lose $2.50 a pound on a chemical for which a farmer is paying two and one half times the cost for which the chemical can eventually be marketed. A still further irony is that by the time a material reaches the comfortable stage, where its use is profitable to both manufacturer and farmer, a better chemical comes along and the cycle begins all over again. It is sometimes difficult to see why, in spite of these anomalies, industrial research toward better insecticides continues and the unit cost of insect control goes down as newer and better materials are developed.

Vertebrate Toxicity

IN many ways, the problem of vertebrate toxicity is like the problem of cost. A new material that is extremely toxic to insects is properly viewed with suspicion. It is likely to be considered so dangerously toxic that its experimental development is greatly retarded. Such materials frequently are indeed dangerously toxic when mishandled and a few deaths may occur from their careless use in the early stages of development. One must always differentiate between toxicity and hazard. Most new insecticides are used in small amounts per acre and in high dilution. The hazard of handling and food poisoning from these materials as used is therefore low. As we better understand their use, and techniques for handling become more practical, hazards decrease even further. Highly toxic materials such as nicotine, cyanide, and tetraethyl pyrophosphate have come to be used regularly with the respect and precautions they require.

The most insidious poisons are those which have residual and cumulative toxic properties such as the arsenicals and perhaps certain of the chlorohydrocarbons. Compounds of this type present a different sort of problem. Here, the innocent bystander may be in danger and intelligent protective legislation and policing is required. Public health scientists, Government regulatory agencies, insecticide manufacturers and experiment station entomologists are working together with increasing understanding and sympathy. The problems involved are serious and require the best thinking and understanding of all concerned.

Phytotoxicity

A TENDENCY to injure plants is often not recognized by the average entomologist as a limitation to the development of new insecticides. The insecticide manufacturer is unfortunately vulnerable to claims against him for plant injury. Formulation research then becomes a major problem with the manufacturer, and a number of excellent insecticides are probably on the research laboratory shelf today instead of in the field because of a minor shortcoming in the carrier, solvent, or emulsifier, which led to occasional plant injury under extreme conditions of usage.

The Development of New Materials

IT is readily recognized that the control of insect pests in the future is an expanding problem, requiring the development of new materials. New aspects of this problem appear almost daily. Some of these that have been mentioned are introduction of new pests, intensification of insect populations, changing crop values, more effective chemicals, application of low-value crops, high cost of finding and developing new chemicals, toxicity to man and animals, plant injury, and probable government regulations.

Some of these aspects bring problems that must be solved by the experiment station entomologists. Other aspects of the problems confront the industrial research laboratories which have been largely responsible for the development of new chemicals. The phases through which a research and development program goes are fairly well known. The research phases consist of applying fundamental knowledge of chemical reactions and insect physiology to a program of synthesis and bioassay. It is no longer sufficient to collect miscellaneous chemicals from a catalog or a chemical storeroom shelf and hope that among them an insecticide of commercial value may be found. At the beginning of the development phase come problems in field testing, formulation, vertebrate toxicity, economic research, and patent law. Only after a candidate compound has gone through these initial phases is it considered ready for release to cooperating experiment stations and other agricultural scientists for their assessment. Even

during this later period, chemical engineers are designing manufacturing facilities and making further plans for an advertising program, and the organization of sales and distribution facilities. At some critical point toward the end of the development program, industry management must make the decision to provide the necessary funds for a commercial development.

It may appear from this viewpoint that tax-supported entomological research plays an unimportant role. This is certainly not the case. Industry must depend first of all on tax-supported research for most of the basic discoveries in chemistry and insect physiology on which its synthesis and bioassay program is based. To an even greater extent, industry depends upon the Federal and State experiment stations to adapt a promising laboratory chemical into a practical insecticide with proper methods for its use in insect control in the various states and on the different crops where it will eventually be used. Of the three links in the research chain, namely, basic research, synthesis and testing, and field certification, industry forms only the second, but nonetheless essential unit.

Closer cooperation between industrial and tax-supported research is essential in meeting the increasingly complex problems of chemical insect control in the future. Better insecticides can be developed with the least cost and delay if we do not make too sharp a difference between the functions of industrial and tax-supported research. Speaking on behalf of industry, we are most anxious to assist the State and Federal experiment stations in their basic research, and in their field certification of our inventions. We have done this in the past with financial support in the form of fellowships, grants-in-aid, and personal cooperation. The mass spectrometers, electron microscopes, elaborate distillation columns, the toxicological and analytical laboratories, and the engineering experience and skills of industry are always available to the sometimes less well-equipped experiment station scientist to help in his problems.

Industry also needs the help of the Government and State entomologist in meeting its own problems. These problems are serious; so serious, in fact, that boards of directors of many chemical companies have

ROY HANSBERRY

seriously questioned whether the investment of stockholders' money in agricultural research was a justifiable business risk. There are four oppressive burdens which are responsible for this critical attitude of management, namely, high cost, restrictive legislation, toxicity scares, and liability. The high cost of industrial research and development results only in part from the high wage scales, material costs, taxes, real estate values and technical services that are part of our present general high economic level. Industrial agricultural research, however, has added costs which also must be passed on to the consumer. These added costs result from the years of development, analytical and toxicological work that must be done in order to meet present restrictive legislation, the danger that a material will be outlawed because of scare publicity with reference to toxicity, and finally, from the manufacturer's liability arising from misuse of chemicals, over which the manufacturer has no control.

Discussions with several directors of the National Agricultural Chemicals Association, who represented leading insecticide manufacturers, on the problems faced by industry in the future of chemical control of insects, brought out some of the following view points:

Cost of Research and Development

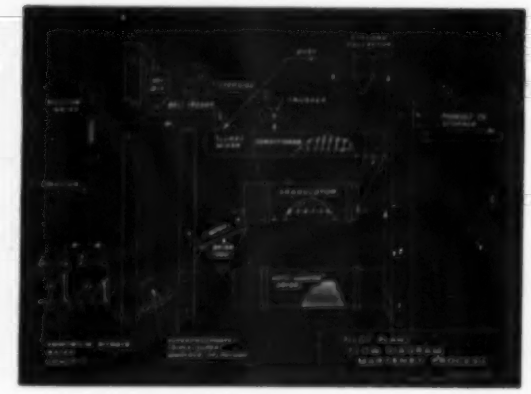
"INDUSTRY research programs continue at a very high level as regards both money and manpower. Possibly this will continue to be the case. We have reached a point now where the minimum cost of discovery, screening, evaluation of toxicity factors, development and introduction of a new chemical have reached really staggering proportions. These expenditures are justified only on the theory that out of all this work a certain number of compounds will develop which will have such highly desirable potentials or potentialities as to justify the further and even heavier expenditures of capital investment for production and sales effort for widespread introduction. In other words, the odds are getting worse all the time."

On Restrictive Legislation

"THE rash of regulatory prohibitions all over the country from the regulatory standpoint, if not carefully controlled, could make it impossible for a manufacturer to stay in business and hope to live up to all of the various regulations involved; not only from an operating standpoint but from an expense standpoint as well. The causes leading up to such legislative prohibitions need to be carefully considered by growers, entomologists and manufacturers, all of whom have a part, in developing the causes, and all of whom certainly have a part in correcting these causes.

"Looking into the future, we believe it would be highly desirable to have the responsibility and the authority of certain government agencies better defined than is currently the case. We do not believe that any one Governmental agency should have the responsibility or authority of both judge and jury, plus the work of an FBI and a local police force."

(*Turn to Page* 135)



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GRANULAR

COMMERCIAL fertilizers until the late twenties, in the United States, were made generally by dry mixing superphosphate, sulphate of ammonia, potash salts with the addition of some conditioners and fillers, such as tankages, seed pomaces, ground limestone, etc. Many commercial fertilizer manufacturers made their requirements of superphosphate. Some of the superphosphate manufacturers made their requirements of sulphuric acid, and a few produced phosphate rock.

During the late twenties, and early thirties, the ammoniation of superphosphate with anhydrous ammonia came into quite general use. This was followed by the development of fertilizer solutions of two types; one being an aqua solution of ammonia and urea, known as urea fertilizer solutions, the other being an aqua solution of ammonia and ammonium nitrate and known as nitrate fertilizer solutions.

The heat reaction of ammonia and superphosphate necessitates the use of coolers to prevent the reversion of citrate soluble pentoxide on storage. Even with cooling to 105° F. in storage, it is unsafe to derive more than three units of nitrogen from fertilizer solutions per ton of complete fertilizers, because of the danger of setting or hardening in packages.

Materials available to secure any larger amount of nitrogen per ton were generally limited to crystalline urea, ammonium nitrate, sodium nitrate, cyanamid and ammonium sulphate.

Because of the unusual solubilities of ammonium nitrate, and because of the hygroscopicity of ammonium nitrate, sodium nitrate and urea, it was impractical to use either in amounts greater than were in the fertilizer solutions when they were used at the above rate. Because of the basic qualities of cyanamid, it is impractical to use this source when the acidity of the superphosphate has been satisfied with ammonia, as is done in using solutions. This leaves only ammonium sulfate as a practical source of nitrogen in quantity for use in dry mixing of fertilizers. Ammonium sulfate was very limited in supply and the production was not increased to take care of the increased demand of nitrogen by agriculture.

This, then, forced the consumers of high nitrogen fertilizers, who were unable to buy the nitrogen in the form of mixed fertilizers, to purchase ammonium nitrate, ammonium nitrate sulfate, nitrate of soda, and other sources of nitrogen salts, or anhydrous ammonia, or fertilizer solutions. As the demand increased for more and more nitrogen, fertilizer manufacturers found themselves severely handicapped in their ability to furnish high nitrogen fertilizers, or fertilizers of a high ratio of nitrogen to pentoxide. In that part of the mid-west most experienced in the use of complete fertilizers, that is, Ohio, Indiana and the southern peninsula of Michigan, the demand is for approximately 70% of a 1-4-4 ratio, and 20% of a 1-1-1 ratio. The remaining 10% is distributed among a number of other ratios. Fertilizer manufacturers, making 20% superphosphate, buying 60% potash salts, 40% fertilizer solutions and 21% ammonium sulfate, can make in a 1-4-4 ratio, no higher grade than a 3-12-12 and in a 1-1-1 ratio, no higher than an 8-8-8. If they are willing to discard their superphosphate plants and buy all of their pentoxide as triple superphosphate, or 75% phosphoric acid, they would be limited to a 4-16-16 and a 11-11-11, respectively.

These procedures would require that all nitrogen, except three units per ton of product, would be derived from ammonium sulfate. Ammonium sulfate is expensive and in insufficient supply to do this. The cheapest form of fixed nitrogen is anhydrous ammonia, and the next cheapest to produce at present is ammonium nitrate solution as it comes from the reactor, generally known in the trade as 83% ammonium nitrate solution. Both of these forms are available in ample quantities.

The problem thus resolves into the question of how can high analysis complete fertilizers be made of physical properties that permit storage in bulk or bags for long periods, without deterioration, and made with ammonia and ammonium nitrate as the sole sources of nitrogen.

The process described in this article produces complete fertilizers that answer all these requirements. For example: a 4-16-16 fertilizer may be made from ammonia, am-

FERTILIZER PRODUCTION

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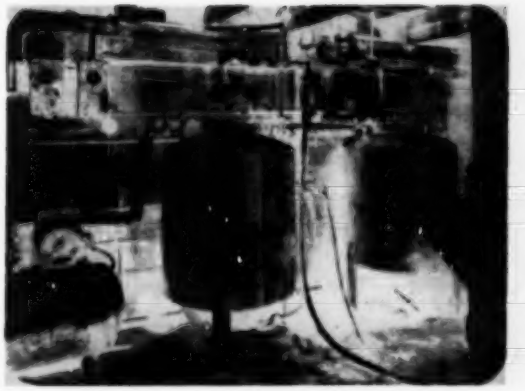
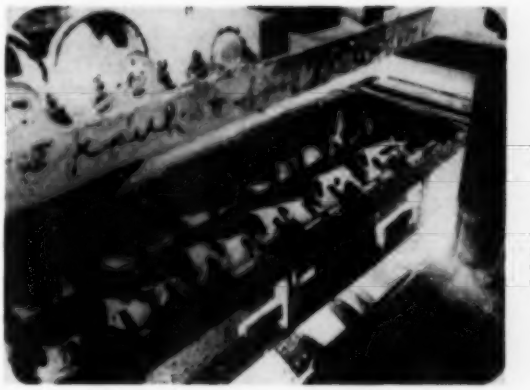
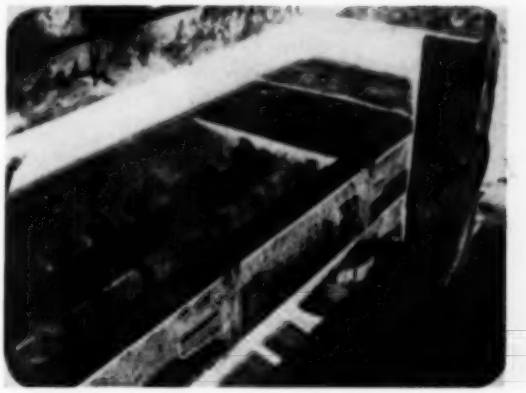
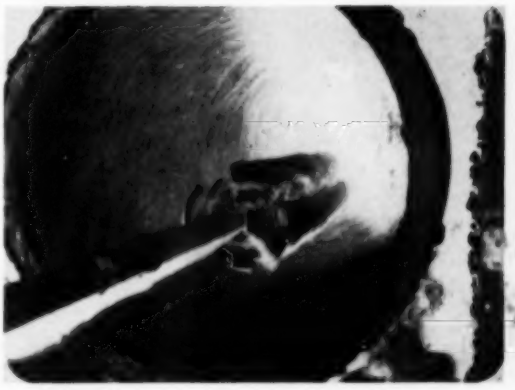




Top photo: Ammonium nitrate solution, water and ammonia are combined into the "liquid phase." Second from top: the solid phase is screened through a vibrating screen, the oversize being crushed and re-screened.



Right: A slurry is effected by distributing the liquid phase under the surface of the solid phase, as it enters the front end of the slurry mixer.



Right: Material from the slurry mixer passes to a conditioning mixer and then to a granulator, which is a revolving shell equipped with a longitudinal paddle shaft.

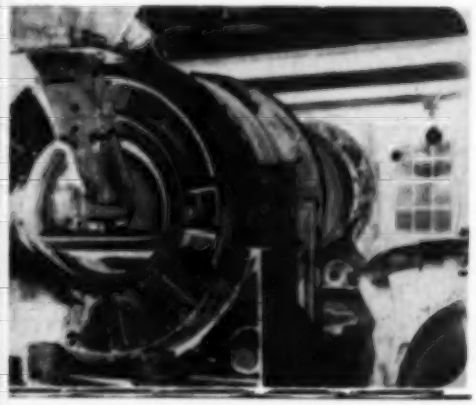
monium nitrate, 61% potash and 22.85% phosphate; and a 12-12-12 fertilizer with the same ingredients, if the phosphate is brought up to 23.4% pentoxide. In the 4-16-16, better than 78% pentoxide may be derived from 20% superphosphate; and in the 12-12-12—75% may be derived from 20% superphosphate. The higher concentration of superphosphate may be obtained by the use of a mixed phosphoric and sulphuric acid reaction with phosphate rock, or by replacing part of the normal superphosphate with triple superphosphate.

Continuous Production Process

BY using triple superphosphate, analyzing 46% available pentoxide or better, it is possible to make these ratios with analyses as high as 6-24-24, and 16-16-16, respectively. The Process is as follows:

Ammonium nitrate solution, water and ammonia are brought together in what is referred to as "The Liquid Phase." A solid phase consisting of superphosphate, triple superphosphate, potash salts, and such other salts as trace elements, etc., is screened through a 10 mesh vibrating screen. The oversize is crushed and re-screened. This screening is desirable to effect practical homogeneity of the product. The liquid phase is made up of ammonia, 83% ammonium nitrate solution, nitrate fertilizer solutions, and water, or any of them, in the proportions necessary to reach the final analysis

*Paper presented at Fertiliser Symposium of American Institute of Chemical Engineers, Hotel Statler, March 10, Washington, D. C.



Top photo: Granules emerging from the granulator are passed over a 5 mesh vibrating screen and separated into dryer feed and oversize recycle, the latter being returned to the paddle mixer.

Second from top photo: The dryer is a rotary, externally heated system of the louvre type, manufactured by the Link-Belt Co.

Third photo from top: After drying, the product is cooled below 105°F. to prevent reversion of the pentoxide in bulk storage.

Bottom photo: The final product has a particle size ranging from 8 to 60 mesh. Only 5% of the material is retained on the 60 screen, 80 per cent being retained on screens 8, 10 and 20.

desired. This liquid phase must generally be held at 130° F. or above, to prevent supersaturation and crystallization.

The solid phase is fed continuously through an automatic weight feeder into a slurry mixer of double paddle shaft design. The liquid phase is fed continuously into the mixer through a rotameter and ratio control system, coupled to the dry feeder. It is unnecessary to bring the elements of the liquid phase together before going into the slurry mixer. If preferred, they may be proportioned and introduced into the mixer separately.

A slurry is effected by distributing the liquid phase under the surface of the solid phase as it enters the front end of the slurry mixer. On combination of the liquid and solid phases, a slurry is formed immediately. This slurry contains from 10% to 16½% total moisture, depending on the analysis of the final product and is thoroughly mixed. The temperature of the mass becomes 165° to 200° F. during its passage through the mixer. A slurry must be maintained to bring about the desired chemical reactions and to secure homogeneity of the product. The material remains in the slurry mixer from 10 to 15 seconds, at which time it spills over a retaining dam at the end of the slurry mixer into a conditioning mixer of similar design. Here, the materials receive a crushed, recycle material which has passed through a mixer and granulator, and has been rejected as oversize from a 5 mesh screen immediately ahead of the dryer. The recycle material is 2½ to 5 times the weight of the slurry.

The mass is converted, while travelling the length of the conditioning mixer, to soft granules ranging in size from ½" diameter to very small pellets. The material remains in this conditioning mixer from 10 to 15 seconds. In the conditioning mixer, the temperature becomes 115° to 120° F. before entering the granulator, and the moisture rises from 7 to 15%. It is important to note that the addition of recycle to the contents of the second conditioning paddle mixer reduces the tendency of the material to coat the shafts and paddles of the mixer, and conditions it to flow freely and continuously in its pellet form into and through the granulator. The physical condition of the granules or pellets is such that they have no tendency to adhere to each other, but flow freely through chutes and can be screened without blinding over.

Oversize Particles are Recycled

THE granulator is a revolving shell equipped with a longitudinal paddle shaft of relatively small diameter and high speed located 1" off the bottom of the inside of the shell. A bed of granules is built along the length of the granulator and is held in such a position by rotation that the agitator lifts the particles, cuts, rolls and aerates them during passage through it. The temperature of the material becomes 95° to 105° F., and the moisture content 6 to 13½%.

Granules emerging from the granulator are passed over a 5 mesh vibrating screen and separated into dryer feed and oversize recycle. The

(*Continued on Page* 138)

Toxicological Considerations in

USE OF DITHIOCARBAMATES

By C. Kampmeier and H. B. Haag

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THE metallic bisdithiocarbamates have been widely used in recent years for the control of crop diseases. This paper deals with factors pertinent to the safe use of two such compounds, zinc ethylene bisdithiocarbamate (zineb) and disodium ethylene bisdithiocarbamate (nabam), which are employed for the control of a large number of fungous diseases affecting fruit, vegetable and ornamental crops.

Detailed toxicologic studies of zineb and nabam have been published by Smith, Finnegan, Larson, Sahyoun, Dreyfuss and Haag (1). The preparations studied toxicologically were commercial formulations known as Dithane Z-78® (containing 65 per cent zinc ethylene bisdithiocarbamate) and Dithane D-14® (containing 19 per cent disodium ethylene bisdithiocarbamate). In this paper, their findings and other results are reviewed as they relate to the practical use of these materials.

Two potential hazards arise in the use of any pesticide against crop diseases. The first is the possibility of injury to the agricultural worker who handles such materials, and the second is the possibility of injury to the consumer of crops bearing such materials as spray residue. Since hazard is a function of two variables; toxicity (innate capacity to injure) and exposure, the potential hazards afforded agricultural users and food consumers are different and must be assessed separately.

Potential Hazards in Handling

EXPOSURE in handling involves possible contamination of the skin and eyes and accidental oral ingestion. The irritating properties of nabam and zineb have been studied in the rabbit eye and on human skin. Nabam produced no irritation when dropped into the rabbit eye and zineb was only mildly irritating. When nabam and zineb were applied to the skin of humans and kept in contact for 48 hours, mild irritation was seen in 2 of 25 subjects in the case of nabam, and in 1 of 50 subjects in the case of zineb. When reapplication was made in the same subjects two weeks later to determine whether sensitization had occurred, the results with zineb were the same as before, indicating only mild irritation in one subject. However, in the case of nabam, 13 of the 25 subjects showed significant positive reactions, indicating that nabam is a definite sensitizing agent. Hence, zineb appears to offer no significant hazard from the standpoint of skin or eye irritation or skin sensitization. The data in regard to nabam counsel care to avoid skin or eye contact. In the event of accidental contamination of either the skin or eye with nabam, the contaminated area should be immediately and copiously flushed with water.

The acute oral lethal dose (LD_{50}) of zineb in the albino rat was found to be in excess of 5200 mgm./kgm., indicating that the potential hazard from the accidental acute ingestion of this material is low. For nabam, the acute oral toxicity was found to be much greater, the acute oral LD_{50} in the rat being approximately 395 mgm./kgm. This figure is in line with the finding of Kligman and Rosenweig (2), who reported that the acute oral LD_{50} of nabam in mice is 580 mgm./kgm. These findings indicate that nabam is a compound of moderate oral toxicity and that care should be taken to avoid oral ingestion.

The above figures and those presented below in connection with residue hazards refer to the active ingredients, zineb and nabam. The toxic doses of the commercial formulations would be higher in proportion to their content of active ingredients. If one assumes that human response would be the same as the rat, these figures suggest that a 175 lb. man would have a 50-50 chance of surviving a dosage of 1.4 lbs. of Dithane Z-78.

The results of these laboratory experiments have been confirmed by use experience. Millions of pounds of zineb and millions of gallons of nabam have been used during the past ten years. Isolated instances of skin irritation have been reported. No other toxic symptoms have been noted. In particular, there are no known reports of injury as the result of ingestion by man or animal.

Potential Hazards Presented by the Consumption of Spray Residue

ONLY zineb need be considered in evaluating potential hazards attending the consumption of spray residue, since nabam is converted by reaction with zinc sulfate to zineb prior to spray use.

Seifter and Ehrich (3) reported that nabam is goitrogenic in rats when fed at dietary levels as low as 1,000 parts per million (p.p.m.) for ten days. The possible goitrogenic effects of zineb were studied by feeding this material at six dietary levels (0, 500, 1000, 2500, 5,000 and 10,000 p.p.m.) to groups of 10 albino rats, 5 male and 5 female, for periods of 10, 20 and 30 days. Using Seifter's histopathologic criteria of goitrogenicity, it was found that a dietary level of 10,000 p.p.m. fed for 30 days was required to produce unequivocal microscopic evidence of goitrogenic activity. Hence, it would appear that zineb is less than 10 per cent as active as nabam in producing overgrowth of the thyroid gland.

There is now fair agreement among workers in toxicology that for the present the most practical method of estimating the hazards which may attend the lifetime ingestion of a chemical by man is to feed it to rats for a period of two years (the average life span of albino rats) and to a longer lived animal such as the dog for one year. Zineb was fed at six dietary levels (0, 500, 1000, 2500, 5,000 and 10,000 p.p.m.) to groups of 20 albino rats, 10 male and 10 female, for a period of 2 years. The animals were individually caged and weighed weekly. Blood studies were made at the end of the 11th and 22nd months. Animals dying during the experiment and survivors were subjected to gross and microscopic pathologic studies. Apparent increased mortality appeared in the females at the 10,000 p.p.m. level and possibly at the 5,000 p.p.m. level, but no such effect appeared in the males even at the highest level fed. A tendency toward diminished growth appeared in both sexes at the 10,000 p.p.m. level. Findings in the blood studies were within normal limits.

The only specific pathologic change found was overgrowth of the thyroid gland which appeared in some of the rats fed 500 p.p.m. and in a majority of the animals fed higher levels.

Zineb was also fed at 3 dietary levels (20, 200 and 10,000 p.p.m.) to groups of 3 adult mongrel dogs for a period of one year, and the same observations made as noted above in connection with the 2 year rat study. No pathologic effects were noted in the animals on the two lower feeding levels. At the 10,000 p.p.m. level a mild thyroid overgrowth was the only positive pathologic finding.

Since the acute toxicity and subacute goitrogenicity data indicated that zineb is of the order of one tenth as toxic as nabam, a study was made to determine whether this might be due to poor absorption of the less soluble zinc compound. Comparisons of the dietary intake and fecal output of zineb were made in 12 rats. These analyses indicated that approximately 70 per cent of the ingested zineb was excreted in the feces. A second experiment was done in which known amounts of zineb were mixed with rat intestinal contents and incubated in a moist chamber at 39°C. for 24 hours, the approximate sojourn of ingested material in the gastrointestinal tract of this species. Analyses showed an average loss of about 15 per cent of the added zineb. When this loss is added to the amount excreted in the feces, it appears that only about 15 per cent of that ingested is absorbed from the gastrointestinal tract.

In arriving at an estimate of potential hazard, the above data must be considered in the light of known spray residue levels. Krister and Wilson (4) have recently reported that the harvest time residues of zineb on cabbage, celery, tomatoes, cucumbers and lettuce range between 0.6 and 2.1 p.p.m. No zineb was found in potatoes at harvest. It was noted that residues are markedly reduced by washing. Spot checks on canned fruits and vegetables to ascertain the effects of processing and canning revealed no residue in excess of 0.4 p.p.m. Stanley (5) has reported no zineb residue in potato tubers; up to 1.1 p.p.m. zineb on celery and less than 1.0 p.p.m. on tomatoes. Meyers (6) has reported zineb residues of 1.3 p.p.m. on apples at harvest following a full season spray program. Fresh figs sampled immediately after the last application showed 13.0 p.p.m. zineb. The canned product following normal harvesting procedure ranged from 0.3 to 1.5 p.p.m. zineb.

When the proportion of such foods in the total human diet is considered, it is clear that dilution with other foods would reduce the possible human intake to less than 1.0 p.p.m. Zineb at 500 p.p.m. in the total diet for the average lifetime of the rat produced no signs of toxicity except a borderline goitrogenic effect in less than half the animals studied; and 2,000 p.p.m. in the total diet for one year produced no discernible toxic effects in the dog. It would appear unlikely that the one p.p.m. or less which might appear in the total human diet would afford a hazard to the consumer.

Summary and Conclusions

Zineb and nabam are used extensively as agricultural fungicides.

Zineb and nabam apparently offer no significant toxicologic hazards to the agricultural worker.

Zineb residues on treated food crops range from 0 to 13 p.p.m.

It appears unlikely that the one p.p.m. or less of zineb which might appear in the total human diet would afford a hazard to the consumer.

Nabam is not used alone and does not appear as spray residue and hence poses no problem from this standpoint. However, it is a compound of moderate toxicity and care should be taken to avoid accidental ingestion. Nabam is a sensitizing agent and skin and eye contact should be avoided.

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North Central E.S.A. Talks On Integration

H. H. Gunderson, Iowa State College, Named Chairman-Elect

H. H. Gunderson, Iowa State College, 1956 chairman-elect of the North Central States branch, Entomological Society of America, center, is escorted to the speaker's table by T. C. Allen, left, 1955 chairman and Howard O. Deay, Purdue, chairman of nominating committee.

INTEGRATION within the field of entomology keynoted the first general session of the Ninth Conference, North Central States Branch, Entomological Society of America, as entomologists from the Midwest met at Omaha, Nebraska, March 25 and 26.

H. H. Ross, President of the Entomological Society of America pointed out that the foundational aim of scientific societies is the transmission of information from one worker to another. He said that only in this way can each one of us draw from the experience and discoveries of others, past and present, and implement our own work with items about which we didn't know but which are vital to the progress of the problem in hand.

"The Entomological Society of America is no exception," he said. "The communication system it represents has been of the greatest importance in advancing the field of entomology in all its phases."

Reorganization of the Bureau of Entomology and Plant quarantine was explained by C. H. Hoffman of the Entomology Research Branch of the Agricultural Research Service. With the exception of the Stored Products division under the Agricultural Marketing Service and the forest insect and white pine blister rust work with the Forest Service, most of the former functions will be under Agricultural Research Service, Entomology Research Branch, headed by Dr. Knipling. This is divided into Sections of Bee Culture and Biological Control, Fruit Insect Investigations, Insecticide Investigations, Insects Affecting Man and Animals, Cereal and Forage Insect Investigation, Insect Detection and Identification, Insects Affecting Cotton and Other Fiber Plants, and Truck Crop and Garden Insect Investigations. The Crops Regulatory Programs headed by A. S. Hoyt will have a Plant Quarantine Branch and a Plant Pest Control Branch, the latter in charge of the Economic Pest Survey and having the responsibility formerly held by the Insecticide Branch of PMA.

H. B. Mills of Illinois in discussing Relationship and Integration of Fields within Entomology stressed the fact that the science of entomology started from a central point, spread out in diverging lines and is now converging to a new point which can be termed true progress. Insect control is at the apex of the pyramid of entomology and the economic entomologist must know something of all phases of the field. Dr. Mills closed his remarks by saying that we need more "Bellybustin" entomology.

C. R. Neiswander of Ohio in discussing the relationship of insect toxicology and control to other branches of entomological science pointed out that the early entomologists were largely naturalists and control measures were extremely practical, involving rotations, time of planting and harvesting and other mechanical measures. Today, economic entomology has become largely chemical. Many serious pests have been readily controlled, but for how long is questionable. Due to rapid advancement and changes, many states publish new control recommendations annually, and if not published immediately they may become obsolete

It was a busy convention for Mr. Gunderson. At left he is congratulated by H. H. Ross, national president of E.S.A., right, while C. C. Compton, Shell Chemical Co., committee member, looks on. In center photo the 1956 chairman-elect receives portfolio from 1955 chairman T. C. Allen. At right Mr. Gunderson joins with George C. Decker, left, Illinois Natural History Survey, in congratulating T. C. Allen, University of Wisconsin, for his job as chairman of the organization. The meetings were held at Omaha, Neb., on March 25 and 26.

by the time they reach the public.

Neiswander stated "One of the criticisms being heaped on the entomological profession today is that the new sprays are upsetting the balance in nature. However, if the balance in nature is so important, the prairies should never have been plowed down and planted to corn. The forested areas should never have been cleared. Timber wolves should still be permitted to roam abroad seizing their food where they may. In fact, if the balance of nature is so sacred, the dreaded human diseases such as cholera, bubonic plague, yellow fever, smallpox, diphtheria and many others that were so prevalent a few years ago should not have been essentially wiped out. If these diseases had not been controlled, we probably would not be worrying today about the over population that is thought to be confronting the world only a few years ahead."

"Every time a potato field is sprayed, the balance in nature is upset in that field. Consumers do not like the small, gnarled and wormy potatoes such as they would have if the plants were not protected from the insects and diseases that normally compete with potatoes in establishing the so-called balance. Man is not interested in maintaining the balance in nature, he is interested in having it unbalanced in his favor."

Neiswander reported that in 1949 the use of DDT as an orchard spray reduced the percentage of wormy apples about 95 per cent over that obtained at that time by the lead arsenate schedule. A comprehensive control test set up in 1953, in which lead arsenate was again used in comparison with DDT as well as with a number of other new materials, showed that lead arsenate in fact reduced the codling moth population approximately 85 per cent over that obtained with DDT. There was almost a complete reversal in the action of these two materials within a period of eight years.

He also stated that if insects develop a resistance to insecticides, why should they not also develop a tolerance to unfavorable host plants? If that should eventuate, investigations of crop strain resistance to insects would also become transitory in nature.

"If insecticides eventually fail," Neiswander asserted, growers may be forced to accept the less effective results obtained with parasites and predators, but not until then will they give up the insecticide program."

J. W. Apple of Wisconsin reported that enough seed treatment was sold in the Midwest to treat seed corn for 5,000,000 acres. In Wisconsin evaluation tests in a field infested with wireworm showed that seed treated at the rate of one ounce of actual lindane per bushel gave a 92 per cent stand, treated with two ounces of dieldrin per bushel the stand was 83 per cent, and with fungicide only, 53 per cent. Apple stated that there has been no indication that seed or seedling injury is accentuated by storing lindane or dieldrin-treated corn seed for as much as 22 months under normal room conditions.

Several states did not obtain good wireworm control with seed treatment when high populations of wireworms were present.

J. H. Bigger of Illinois reported on soil treatments with aldrin as a standard insecticide. In June the treated areas in these fields were 7.6 per cent taller than the plants in the untreated areas, at tasselling time 16.8 per cent of the tassels were further advanced than in the untreated areas, and of 17 fields which were hand-picked for yield data, the treated areas yielded 4.2 per cent more corn than did the untreated areas.

Experimental work in Kansas by C. C. Burkhardt on the annual white grub in wheat showed it to be effectively controlled by dieldrin and heptachlor drilled in with the wheat at the rate of two pounds of toxicant per acre. There were 742 plants per hundred feet of row in the dieldrin treatment and 747 with the heptachlor treatment, while the check area had only 206 plants in the same area.

Kansas has a comprehensive and well planned clean grain program which has been in operation since 1949. Dell Gates, who has been instrumental in the execution of the Kansas program, reported that in 1949 21,000 farmers sprayed and cleaned their bins prior to storage of grain. In 1950, 25,000 farmers had followed this practice, and by 1952, 34,000 farmers acted. In 1953, 38,000 farmers followed this clean-and-spray-the-bin formula. In 1951, 20,000 farmers fumigated 15,500,000 bushels of wheat: in 1952, 23,500 farmers fumigated 20,800,000 bushels of wheat: and in 1953, 28,000 farmers fumigated 21,362,400 bushels of wheat. In 1952, 9,500 farmers used a grain protectant.

The value of the program is well illustrated by the decrease in the

North Central E.S.A. executive board is pictured at left. Front row, l. to r., Mr. Allen, R. E. Hill, U. of Nebraska; H. M. Harris, Iowa State; Roy W. Rings, Ohio State; back row, Mr. Gunderson, T. H. Parks, Ohio State and J. W. Apple, U. of Wisconsin. Local arrangements committee is shown at right. From left, Clifford Walstrom, Nebraska; Earl Raun, Iowa State; Chairman Roscoe E. Hill and R. E. Roselle, U. of Nebraska and Ray Fuxa, Miller Chemical Co., Omaha. Entomologists from all over the Midwest attended meetings.

percentage of cars of wheat graded weevily. In 1948 before the Kansas program was inauguarated, 8.5 per cent of the cars were graded as weevily but by 1949, the first year of the program, it had dropped to 4.6 per cent. In 1950, 4.8 per cent was graded weevily: in 1951, 3.3, and in 1952, 0.3 per cent was graded as weevily. These results were not all claimed for the program, Gates stated, but the emphasis on clean grain and the action of Kansas farmers was certainly instrumental in such fine results.

R. E. Roselle reported from Nebraska that their program was just getting well underway, and farmers were beginning to follow the suggested control measures. A survey was made in the spring of 1953, prior to inaugurating the program, and showed that 3.6 per cent of the farmers' bins contained weevil and 22.4 per cent had been contaminated by rats, mice or birds. Of the country elevators sampled, 23.9 per cent of the bins contained weevil and 36.2 per cent of the bins contained rat, mouse, or bird contamination.

Randall Latta of the USDA Agricultural Marketing Service discussed tests with ryania, lindane and activated pyrethrins as protectants for stored grain. All materials gave good control in the late summer but control was not as successful with low dosages. The insect populations of the untreated grain increased steadily throughout the summer.

In discussing the status of grain protectants, Don Wilbur of Kansas stated that there was no appreciable control of Indian meal moth and flour beetles. He described a series of tests in which applications were made by the farmers. "Farm bin treatments resulted in the protection of the market wheat from most of the important grain damaging insects," he reported. "Cadelle, flat grain beetle, and saw-toothed grain beetle, the three most abundant species in Central Kansas farm-stored wheat, were greatly reduced or eliminated by treatment of the wheat even when treated bins were adjacent to untreated and heavily infested wheat.

G. C. Decker of Illinois, 1953 Chairman of the Branch, pointed out that for years entomologists have been ultra-conservative in their estimates of insect damage. He stated that grasshoppers in the "good old days" drove pioneers back east, chinch bugs caused many to abandon agriculture, armyworms were an annual occurence in many areas and potato beetles swarmed over the fields. Pioneers accepted as quality that which the insects left, and many times the worms took all. The pioneer little dreamed that within 100 years the food which he accepted would not even be considered as poor quality but would be discarded. Each year our food standards become more severe and even though our control methods have greatly improved, our marketing standards for quality produce have also increased; thus cancelling some of the benefits of control.

Once the housewife has seen quality food, she will accept nothing less. Decker believes that entomologists can and will meet this increased demand for quality production. Without the use of insecticides, however, the people of our United States would be reduced to a diet of rice, wheat, corn, and meat.

To illustrate how estimations might be improved, Decker stated "In 1918 Morrill measured the food requirements of the differential grasshopper (*M. differentialis*) and then calculated that 7½ adult hoppers per square yard would consume 1/100 of a ton of alfalfa hay per acre per day, or that approximately 17 hoppers per square yard in a 40 acre field would consume a ton of alfalfa hay per day. This same technique could very profitably be employed to obtain similar values for many other pests."

"With our national agricultural production approaching 40 billion dollars, by applying the old 10 per cent loss factor we find that insects impose a tax on American agriculture amounting to approximately four billion dollars annually, which is roughly four times the total taxes paid by the farmers of this country on all agricultural real estate and personal property."

True and apparent resistance on the part of insects was discussed by Clifford C. Roan of Kansas. Roan stated: "The use of the term insect resistance implies that the insect is responsible. Therefore, it is essential that all other factors be fully evaluated before we credit the insect with special powers. These other factors are concerned with the toxicant itself; the methods of application; the environmental effects on the toxicant; the ratio of insect population to the toxicant, etc."

"In the case where the insect is the responsible party there are at

(*Please Turn to Page* 151)

Paul Mayfield, president of NAC, is made an honorary sheriff of the Harris County Mounted Posse at barbecue dinner.

More than 300 at spring meeting discuss problems, get big Texas reception

NAC Meets at Houston

MEMBERS of the N.A.C. trekked to Houston, Texas, late last month for a spring convention held in the heart of what is normally one of the biggest pesticide consuming areas of the U. S. With well over three hundred on hand, they attended an enthusiastic and information-packed three-day session, — with all the Texas trimmings added except that there was no gushing oil well in the lobby of the Shamrock. An excellent set of practical talks on pressing industry problems had been arranged by the program committee, headed by Howard Grady, California Spray-Chem. Corp., while a 10-man arrangements committee headed by A. Petrus, Cotton States Chemical Co., gave the visitors from the North a royal Texas welcome.

Insecticides Increase Yield

FIRST speaker on the opening morning session was Paul Mayfield, general manager, Naval Stores Department of Hercules Powder Co., Wilmington, and president of the National Agricultural Chemicals Association. Mr. Mayfield observed that while the industry over the course of the past two years has gone through what might be called a shaking down, and while these years have been comparatively unprofitable, the industry has not lost faith in its future. There is reason to believe, he indicated, that 1954 may be the year when the agricultural chemical industry will find itself stronger, healthier and able once more to advance. Certainly, over the long range view, he indicated, there is no room for pessimism in the pesticide industry. The world needs the products of the industry, — needs them for its own well being.

Mr. Mayfield compared yield figures for a series of crops in the period prior to 1945 and for the following years, when many of the new type pesticides were first put on the market. While he made no definite claim that the use of these pesticides was entirely responsible for the surprising increases in crop yields, he did indicate that it is certainly a remarkable coincidence that following introduction of the new type pesticides in 1945, the yield per acre of potatoes had gone up 65%, onions 49%, sweet corn 26%, tomatoes 23%, lima beans 10%, cauliflower 20%, celery 52%, cucumbers 25%, snap beans 30%, milk 10.5% and alfalfa seed 190%.

Perhaps, he observed, the pesticide industry is more spectacular than others. It has spectacular successes — and some spectacular hazards that arise when pesticides are not correctly used. He reminded his listeners that the pesticide industry has an important obligation to tell the public how to use its products wisely and safely. This is why, he indicated, the NAC and the pesticide industry have gone on record for the second time for endorsement of new pesticide legislation in the public interest. He referred, of course, to the Miller Bill which has just passed in the House. Once more, he observed, the pesticide industry has endorsed legislation to regulate itself. Most of the provisos of this proposed new law, he added,

are already being met by the industry, but endorsement of the measure recognizes the necessity for "spelling out" in detail in the law, the principles which the industry has practiced for a number of years.

In summarizing his view of the obligations of the pesticide industry toward users of its products and the general public as well, Mr. Mayfield submitted the following summary of broad overall policies that he indicated should always be the guiding principles of the industry. "As members of the pesticide industry," he commented:

"We believe we should always manufacture chemical products of proved pesticidal worth.

"We believe that we should initiate, obtain and publish factual data on a pesticide's properties and its suggested uses.

"We believe that we are morally responsible to produce products that can, with proper safeguards, be used safely from a health standpoint.

"We believe that we should develop research data regarding a pesticide's limitations, and refrain from recommending its use until substantiating data are obtained.

We believe that we should cooperate willingly and fully with the Department of Agriculture and other pertinent federal government, state, local, and accredited professional agencies, to the end that objective data may be obtained, and correct recommendations be developed.

"We believe that we have the moral responsibility of developing not only a base chemical, but also of instituting a research program for continuous refinement plus control of compounding to exact standards—to the end that each commercial pesticide shall fulfill its mission of serving mankind."

He cautioned that the industry must always be on the alert against the fly-by-night operator who wants to turn a quick dollar. He reminded that the best way to maintain a sound, long range public spirited program, is to build the pesticide business on a solid profit basis. As with any other form of free enterprise, he added, the pesticide industry must generate sufficient profit to enable it to plow back the large funds needed to keep up research, to explore new materials and formulating techniques, to preserve the quality of products, to encourage better and more profitable merchandising methods and to educate the user and the consumer.

John C. White, Commissioner of the Texas State Dept. of Agriculture, also spoke at the opening session. He reported that there currently seems to be much less conflict between rice and cotton farmers surrounding use of 2,4-D and other herbicides. The number of complaints registered officially in the Commissioner's office last year dropped to 112; which compares with an annual total upwards of two thousand back in the 1948-49 period.

The most significant point in his address was his announcement that the use of 2,4-D has just been banned in seven Texas counties. The order affects crop spraying operations in Harris, Liberty, Fort Bend, Brazoria, Wharton, Matagorda and Chambers counties, where 2,4-D has previously been used extensively for weed killing application in rice fields.

The toxic effect of the material on surrounding cotton fields was sighted as the major reason for the change in regulations. This is the first time the Texas Dept. of Agriculture has

In The Photos

1. L. to R. Wm. Feustel, R. T. Vanderbilt Co.; Wm. Haude, Grace Chem. Co.; Mel Goldberg, Pesticide Advisory Service; Carlos Kampmeier, Rohm & Haas Co. and George Krieger, Ethyl Corp.

2. L. to R. Bruce Gleissner, Diamond Alkali Co.; Dr. Walter Dove, U.S.I.; Mercer Rowe, Ashcraft Wilkinson Co. and Wm. K. Self, Riverside Chem. Co.

3. L. to R. Jack Hutchinson, Monsanto Chem. Co.; J. F. Kirk, General Chemical; A. W. Mohr, California Spray Chem. Corp.; Dr. H. L. Haller, U.S.D.A.; John White, Texas Commissioner of Agriculture and P. J. Reno, Hercules Powder Co.

4. L. to R. Jack Miller, Atlas Powder Co.; D. J. Keating and R. H. Lamoree, Stauffer Chem. Co.; Horace W. Lee, Niagara Chem. Div., Food Machinery.

5. L. to R. Arthur Bixby, Penn. Salt Mfg. Co.; J. V. Vernon, Niagara Chem. Div., Food Mach. & Chem. Corp.; K. Krausche, Penn. Salt Mfg. Co., C. P. Zossch, Monsanto Chem. Co. and E. A. Georgi, United Cooperatives.

invoked the power given to it under the Texas herbicide law to outlaw use of a broad leaf plant killer. Instead of 2,4-D, Mr. White recommended use of 2,4,5-T, which he described as equally as effective for weed control, but five to 10 times less damaging to cotton.

The new regulation becomes effective immediately, and commercial spraying companies and farmers in the seven-county area have been given twenty days in which to comply with the order. A second part of the regulation concerns the use of airplanes in spraying fields. Aerial spraying of any type herbicide is prohibited in the Stafford-Missouri city area, where cotton and rice fields are so closely intermingled that it was believed that any type spraying for herbicide control would be unduly dangerous.

Texas Projects Reviewed

R. D. LEWIS, director of the Texas Agricultural Experiment Station reported on "Research on the Use of Chemicals for Texas Agriculture." The Texas station, he noted, now has 324 active research projects, two-thirds of which direct attention to studies of chemicals. The most numerous group of projects engaging the attention of the station is a series of studies on nutrition of poultry, cattle, sheep and swine. Next in importance is a group of 25 studies involving insects and insecticides. Many of these are, of course, concerned with work on cotton, and Mr. Lewis indicated that too little research is being done in Texas on insects and insecticides relating to other crops.

Another group of 19 studies concerns chemicals for the control of weeds and brush. Mr. Lewis expressed his belief that we are probably still only on the threshold of effective use of chemicals for control of weeds, and that there is still a tremendous potential in this market. Studies relating to fungicides, he noted, have attracted only seven "grants-in-aid" and there is ample opportunity in this field for producers of fungicides to cooperate more effectively.

Looking forward to a still wider use of chemicals in the agriculture of Texas, the speaker made the following broad recommendations:

1. There is a need for greater support of so called fundamental or basic research.
2. The interrelations of chemicals with the crop, soils, animals and man must be given greater consideration.
3. Timing and techniques of application of chemicals become of increasing significance in guiding their effective use.
4. The hazards in the use of selective chemicals must be recognized and steps taken to guard against them.
5. The chemical industry and educational agencies must cooperate vigorously in presenting constructive information on the use of chemicals in agriculture.

In The Photos

1. L. to R. Roger Roth, Velsicol Corp.; Felton Byrd, U. S. Rubber Co.; H. E. (Skip) Meadows, Diamond and M. L. Anderson, Velsicol.

2. L. to R. Sam D. Preston, Amer. Cyanamid; T. L. Wilkerson, American Cyanamid; P. D. Peterson, Stauffer Chemical and Harry Kuhn, Ethyl Corp.

3. L. to R. Dr. E. C. Bishopp, Pink Bollworm Project, and Lee Grobe, Jack Dresser and Lea Hitchner of N.A.C.A.

4. L. to R. J. W. Moore, Floridin Co.; John Van Geluwe, G.L.F.; John Rodda, U.S.I. and C. M. Meadows, S. W. Sprayer & Chem. Co.

5. L. to R. Robert Kirk, Consolidated Ind. & Agr. Chemicals; Scott Starkey, Wyandotte Chem. Co.; Howard Fisher, Consolidated I. & A.C.; N. J. Hall, Pioneer Chem. Associates and R. S. Thompson, Thompson-Hayward.

6. L. to R. J. J. Lawler, Shell Chem. Corp.; E. E. Heuermann, Shell; J. B. Maddrey, and Geo. Simches, Planters Chem. Corp. and F. W. Hatch, Shell.

7. L. to R. J. M. Taylor, Taylor Chemical Co., Richard Yates, Hercules Powder Co. and Bruce Rennie, Virginia-Carolina Chemical Co.

8. Group boarding bus for tour of Diamond Alkali Deer Park and Greens Bayou plants.

Sound Credit Policy Outlined

THE agricultural chemicals credit situation was the topic taken by J. A. Walker, credit manager of Standard Oil Company of California in his address. Mr. Walker observed that credit wisely used can be very

helpful in building sales and profits. He warned, however, that careless policies in the extension of credit can result in the supplier performing a bankers function without benefit of adequate security or any interest return on his investment.

Credit, the speaker cautioned, is not something the buyer has to give away, but rather something he takes from the buyer in exchange for his own goods. A sound credit policy is essential to any successful business, he commented and should be in writing. Too much credit is equally as unsound for the buyer as for the seller, he warned. Extension of excessive credit to dealers or distributors can often get them into trouble, by encouraging them to extend credit unwisely themselves.

Past due accounts, the speaker warned, are the ones most likely to be lost to a competitor. When an account becomes past due, chances of collecting it tend to decrease with the age of the account. Special treatment must, of course, be given to past due accounts, he allowed, but in those cases where special credit treatment becomes necessary, this should be thought of merely as a temporary measure and not as any permanent change in the company's credit policy. As soon as possible, credit terms should be restored to normal on delinquent accounts. One of the cornerstones of any sound credit policy, Mr. Walker counseled, is not to forget to ask for your money when it is due.

WILLIAM W. Allen, manager of agricultural chemicals sales of the Dow Chemical Co., Midland, Mich. and vice-president of N.A.C. presided over the Thursday morning session. He introduced the mayor of Houston, Roy Hofheinz, who welcomed N.A.C. members to the city. Lea S. Hitchner, executive secretary of N.A.C. presented his report at the session.

"Technology Implications" was the topic taken by Dr. Herbert L. Haller of USDA, Washington, who reviewed the overall picture of scientific development in the pesticide field and the effect which these recent developments have had on the marketing and use of pesticides. Dr. Haller indicated that the recent reorganization of the Department of Agriculture provides an opportunity to develop a better coordinated approach to the evaluation of pest control chemicals. The insecticide investigations of the former B.E.P.Q. as well as studies on fungicides, nematocides and herbicides have been transferred in the reorganization to the new Crops Research Unit. The new organizational set-up, he said, should in time simplify the relationships of the Department of Agriculture and industry concerned with pest control chemicals. A review of the Department's programs of research on pest control chemicals is now in progress under the direction of Dr. Haller, who will serve as the principal contact with representatives of the chemical industry.

1. L. to R. L. G. Gemmell, Geigy Agr. Chemicals; V. J. Smith, Chipman Chem. Co.; J. W. Kennady, Diamond Alkali and Carl Behse, Agr. Chemicals, Inc.

2. L. to R. Jack Polite, Diamond Alkali; Sam Marshall, Central Chemical Corp.; L. S. Kaniecki and Ogden Swan, Tennessee Corp.

3. L. to R. W. M. Jarnigan, Attapulgus Minerals & Chems. Corp.; Mrs. Jarnigan; Mrs. R. W. Wert and Mr. Wert, also of Attapulgus.

4. L. to R. L. G. Utter, Diamond Alkali; H. F. Tomasek, and F. Scott James, Pittsburgh Coke & Chem. Co.; S. J. Hastings, and J. F. White, Shell Chem.

5. L. to R. L. G. Matthews and Theodore Riedeburg, American Smelting & Refining Co.; John Kennedy, Stauffer and Chas. Smith, Ethyl Corp.

6. L. to R. Clark Bellamy, Acme Fertilizer Co.; Charles Whinfrey, Penn Salt; S. H. Bear, Niagara Chem. Div. Food Machinery and Joseph Dolson, Hercules Powder Co.

7. L. to R. R. N. Cochran, Diamond; J. S. Wolff and D. L. Kent, B. F. Goodrich Chem. Co. and A. V. Riley, Atlas Powder Co.

Plans are under way in the Department, Dr. Haller reported, to expand research on pesticide residues. Several state experiment stations will conduct studies to improve chemical and biological methods of analysis as well as to develop new procedures.

Fertilizer-insecticides mixtures, the speaker asserted, present something of a problem. Uniform distribution of the insecticide throughout the fertilizer is important, — and because fertilizer applications vary widely, there may be a tendency to add either too little or too much insecticide. Where farmers believe that it is more economical for them to apply both insecticide and fertilizer to the soil in one operation, Dr. Haller said he believes that it is up to government and the agricultural chemical industry to see that the job is done properly and efficiently, rather than simply advising the farmer not to use such mixtures.

Systemic insecticides present other problems that demand careful study. The newer organic systemics, he declared have been effective from a practical standpoint against only

(*Continued on Page* 129)

1. L. to R. R. W. Breidenbach, Commercial Solvents Corp.; T. W. Brasfield, Naugatuck Chemical Div.; R. H. Hodgson, John Powell & Co., Inc.; Sol Epstein, Emulsol Corp. and E. H. Phillips, Grange League Federation.

2. L. to R. John Nicholson, Agricultural Chemicals; G. D. Baerman, John Powell & Co., Div. Matheson; I. T. Conner, Taylor Chem. Co.; E. S. Heckathorn, Heckathorn & Co. and Albert Fuchs, Diamond Alkali.

3. L. to R. Marshall Manns and Jack Howe, Michigan Chem. Corp.; R. L. Warren, Rohm & Haas; John L. Giles, Michigan Chemical and G. F. Leonard.

4. L. to R. Jim Merritt, Virginia-Carolina Chem. Corp.; J. E. Bussart, Velsicol Corp.; B. A. Clayton, Black Leaf Products and Angus Stoneleigh, Mathieson Chemical.

5. L. to R. Russell Stoddard, U.S.I.; E. K. Plant and W. F. Newton, Columbia-Southern and E. W. Cannon, Calspray.

6. L. to R. Bruce Rennie, Black Leaf Products Div.; Geo. W. Ahl, Jr., Summit Mining Corp.; Vincent L. Rebak, Grace Chemical Co. and B. A. Clayton, Black Leaf Products Div.

7. "Sheriff" Mayfield and P. J. Reno, right, Hercules Powder, enjoy a joke with host Mrs. Gail Whitcomb and her daughter Gerry, left, at the barbecue given for NAC representatives.

Through the Sifter

THE arrangements Committee for the Houston meeting of NAC did a real bang-up job. Headed by "Pete" Petrus of Cotton States Chemical, the committee included nine other representatives of the southwest area, all of whom worked to put on a highly successful meeting,—with a definite Texas flavor. P. J. Reno, Tom Tennent, Jack Kennady, Gus Garon, Ernie Holmes, Carl Goodwin, Bill Hardy, B. J. Smith and H. E. McClean lined up Texas hats, barbecued beef, guitar music, and even succeeded in getting the entire cast of the Harris County Mounted Posse to contribute to the blowout and chuck wagon dinner served at the Whitcomb Ranch. And a special word of thanks from every one attending the convention might well go to Mrs. Gail Whitcomb and her daughter, Gerry, who were charming hostesses in the true Texas manner.

* * * * *

Missing at this year's spring gathering, but definitely on the "accounted for" list was Bob Zipse, now of the Powell division of Mathieson. Mrs. Z was still expecting, at press time, the arrival of a fourth younger Zipse. Can't flash the news on this one though, we guess, until next month.

* * * * *

Gopp's knitting circle played to a "standing room only" crowd at all sessions.

* * * * *

Insecticide salesmen at Houston had an opportunity to see at first hand what has been responsible for slumping insecticide sales in Texas over recent years. There was plenty of west Texas dust in the air, giving an awesome reminder of the pressing need for rain in this whole area, if cotton growers and cotton poison sellers along with them, are to have a better year in '54.

* * * * *

Latest in the growing list of executive changes is the move made by Tom Snipes. Formerly technical sales representative for U. S. Industrial Chemicals Co., he has just recently joined Chemagro Corp., N. Y.

* * * * *

And don't think, by any means, that the "change partners" routine is over, our agents tell us. There are several more spring housecleanings which could very well develop,—in some rather big outfits.

* * * * *

We think we've got the answer for advertisers who want to get readers to pay more attention to their ads. The answer is, of course, "make a mistake." And one of our good advertisers did just that last month with a piece of copy mentioning the confused flour beetle, as many of our

(*Turn to Page* 151)

More Nitrogen on the Way:

Deere Plant Nears Completion

ANHYDROUS ammonia will be flowing from the Pryor, Okla. plant of Deere & Company in June if present construction plans are continued on schedule. Grand River Chemical Division of Deere reports that final construction of the $20 million nitrogen plant is underway. The new plant will serve the growing nitrogen demands of the broad central belt of the United States, according to L. A. Rowland, vice president of Deere and general manager of Grand River. He said urea will be produced after ammonia gets into production. Rowland explained that Deere's entry into the agricultural chemical field is strictly an adjunct to its traditional farm equipment business.

Compactness and automatic control are among the features of the Pryor plant, company officials state. A new gas oxidation and Casale synthesis process will be employed to produce ammonia, while the Pechiney process will be used to manufacture urea. Rated daily capacity of the plant is 180 tons of NH_3, most of which will be used to produce urea.

Fertilizer grade urea will be guaranteed to contain 45 per cent nitrogen. For easy drilling and improved physical properties, the material will be coated with a special conditioner.

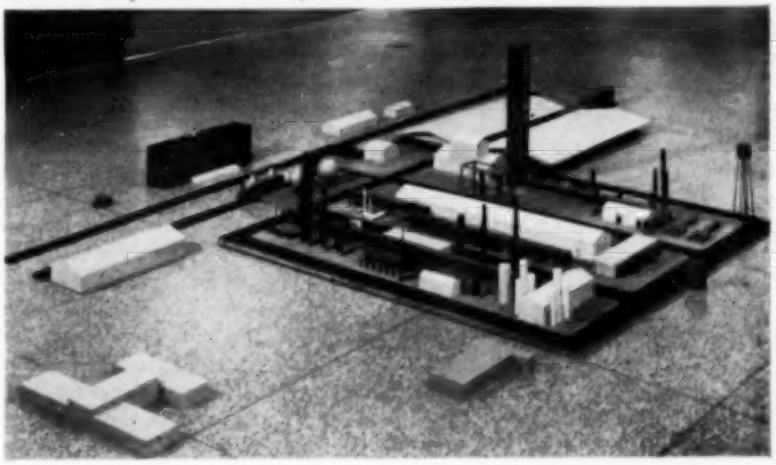
Already completed at the plant site is a modern two-story administration and research building, now occupied by plant personnel. General and sales offices are located at 2010 South Utica, Tulsa, Okla.

The plant's daily requirement of 2,300,000 gallons of water, 125,000 pounds per hour of steam and the power load of 15,000 k.w. will be supplied by the Grand River Authority. The Oklahoma Natural Gas Co. will deliver approximately six million cubic feet of gas a day. The plant is served by the Missouri-Kansas-Texas Railroad.★★

General view of Grand River Chemical Division of Deere & Co.'s nitrogen plant.

Discussing plans for new nitrogen plant are L. A. Rowland, vice president of Deere & Co., and general manager of Grand River Chemical Division, center, W. W. Yeandle, works manager, left, and John R. Taylor, Jr., sales manager.

Model of the plant, located at Pryor, Okla., where anhydrous ammonia will be made.



PESTICIDES

value in raising standards | OF LIVING and HEALTH

By Dr. F. C. Bishopp
Pink Bollworm Research Center
Brownsville, Texas

WE owe much to insecticides. How much we shall probably never know. It is generally impossible to get precise information on benefits derived from the use of a single insecticide in a single community, to say nothing of benefits accruing from the use of many materials under diverse conditions throughout the world.

There seems to be little doubt that without the protection afforded by insecticides many crops would be destroyed completely, armies would be rendered impotent by insect borne diseases, the march of terrible insect scourges across the country would be rapid, and the appalling burden of malaria would continue as a millstone around the neck of the people in vast areas of the world.

In taking stock of the present insect situation, we must consider the total effect, both beneficial and detrimental, of the annual use of millions of tons of insecticides in homes, and on livestock, crops, and forests.

Let us look for a few minutes at the objections to the present wide use of insecticides, and the problems which such use has precipitated. We are forced to admit the necessity of use of pesticides, which means, of course, a considerable outlay on the part of the public for the chemicals themselves, for the equipment to apply them, and for labor required in their application and, in some cases, for the removal of residues. We are ready to admit at the outset, also, that pesticides must be properly stored and used. If this is not done, many adverse, or even disastrous results may follow.

Even though properly used, some undesirable results may be experienced. Careless handling of pesticides has unfortunately resulted in a number of cases of poisoning of people, but considering the tremendous quantities of these materials employed throughout the country it would seem that the accidents resulting have been surprisingly small. It is interesting to compare the number of cases of poisonings, or reported poisonings, due to insecticides, with those chargeable to commonly used materials not generally regarded as hazards. In 1951, 14 deaths were reported as resulting from DDT, but as stated by competent medical authorities, most of these were really due to the solvents used. Vital statistics published by the Federal Security Agency for 1949 show aspirin to be responsible for 20 accidental deaths, kerosene and other petroleum products for 117, lye and related material for 87, and barbituates for 466.

The hazards from pesticide residues on crops, livestock, etc. have received much attention. Most of the statements, widely circulated in the past, have been biased and misleading and have tended to affect the public adversely by causing them to fear being poisoned by residues and thus keeping them from using pesticides when needed. Only a few cases of poisoning have been reported from insecticide residues and these were due to gross carelessness.

The effect of pesticides on various beneficial insects, wildlife, and fish is of considerable concern. Insecticides that have ability to kill many pest insects naturally destroy the beneficial ones. These have suffered heavily in many areas and in some cases the pollination of crops by such insects has been reduced. The deleterious effect of insecticides on parasites and predators has been apparent in many areas, and in some instances has been responsible for increase in abundance and injury by other pests which were formerly controlled by natural enemies.

There is little evidence however, that wildlife in general has been affected materially by the wide use of pesticides. Destruction of weeds and brush has made necessary the movement of wildlife from one area to another, and in some cases has re-

*Before Natl. Agr. Chems. Assn., Houston, Tex., Mar. 24, 1954.

duced the food and cover for game birds and animals, but in general these ill effects have been of a minor nature. The relative susceptibility of fish to the action of a number of insecticides is well known, and we have on record several instances where fish have been killed in considerable numbers by these materials. In most cases, however, this has been due to improper use.

Another point which should be mentioned in connection with points against insecticides is the fact that in a good many instances applications of pesticides have been made unnecessarily. This, again should be classed as improper use.

These points which might be regarded as objections to the use of insecticides are insignificant when the advantages from their use are considered.

Insects Man's Worst Enemy

INSECTS continue to be man's worst enemy. These formidable foes are constantly competing with man for food, are destroying his shelters, his works of art, his lines of communication, and his raiment. They interfere with his work by day and his sleep by night, turn his periods of recreation into nightmares and infect him with deadly maladies.

Some who live in well screened homes and work in closed air-conditioned buildings with an abundant supply of insecticides and repellents at hand may say we are overstating the case of the insect menace. However, if we look at the situation from a world viewpoint, the picture can readily be made even darker. Even here in the United States there are still areas and times where and when insect conditions are almost intolerable. Despite the advances made in insect control, the annual loss in the United States due to these pests has been estimated by some workers at 4 billion dollars, and by others at more than 10 billion dollars.

But, you ask, are we gaining no ground in our struggle against insect pests? The answer is definitely—yes. These gains and the great opportunities ahead in conquering insects through the more complete adoption of known control methods and the development through research and trial of new ones is demonstrated by recent accomplishments.

Years ago I heard the theory advanced many times that we might as well let the insects destroy a portion of the crop, as full production would lower prices so that the return to the farmer would be no greater than if the insects were allowed to take a portion of his crops. This theory is still advanced occasionally and the point is frequently made that through the application of modern scientific methods crop production is increased so that we are constantly confronted with the problem of surpluses. However, any way you take it, there is no economy in feeding bugs or allowing plant diseases and weeds to take our crops.

The planting of reduced acreages and the utilization of every known method of increasing production per acre is definitely the best procedure. These steps, together with improved and more equitable distribution of food products to the undernourished millions of the world, should take care of the situation.

Furthermore, we should give consideration to the ever increasing population which must be fed and clothed. Latest information indicates that we have over 161,000,000 people in the United States today and the increase is over 2½ million a year. It has also been forcefully pointed out that we have available only a few million additional acres of land that can be brought into cultivation. With the prospective population in 1975 of 207 million, a tremendous increase in food, feed and fiber production is required. This points up the need for increased production on every acre if we are to continue to hold our place as the best fed and clothed nation in the world.

Diseases of various crops and forest trees are also placing a heavy tax upon us. This is true too of weeds. As a matter of fact recent estimates made by the Department of Agriculture indicate that the total value of crops affected by diseases is reduced by $2,800,000,000, or about 7% of the United States' potential production of all farm and forest products. Losses from diseases of forest trees have been estimated at $56,000,000 of which $50,000,000 represents growth loss and increase in culls, and $6,000,000 loss of standing timber. These figures do not include losses resulting from disease organisms after lumber has been harvested and put to various uses.

Although large sums have been saved through the use of plant disease control agents applied to various crops, losses are still heavy, and the need for increased research in the development of fungicides and related materials and their application, particularly as preventives, is obvious. This is especially true with reference to diseases of forests.

It has been estimated that weeds are responsible for loss of production by more than 10% of the crop value. This would mean nearly $1,800,000,000 which would be equivalent to a loss of production of more than 37,000,000 acres of agricultural land.

The control of weeds and brush by herbicides has come to be depended upon throughout the country. The usage of these materials has not only saved a tremendous amount of labor, but has also resulted in substantial increases in crop and livestock production. The fact should not be lost sight of that the proper use of fungicides and herbicides is, at times, of considerable value also in combating insect pests.

Insecticide Use Essential

THE use of insecticides and other methods of insect control is not only necessary to provide food, feed, and fiber for today's requirements, but also to protect future generations through the prevention of soil erosion and floods to which the work of insects contributes materially. Wind and water erosion is often intensified by outbreaks of such pests as grasshoppers, cutworms, range caterpillars, and white grubs; each of which can be successfully controlled with insecticides.

For many years fruit raisers have been aware of the necessity of using insecticides and fungicides freely in order to protect their high value

(*Continued on Page 126*)

Particle size and composition studies of

Granular Fertilizers

By R. M. Magnuss and J. O. Hardesty

U. S. Department of Agriculture, Beltsville, Md.

THE technique of granulating mixed fertilizers continues to receive much attention throughout the fertilizer industry. At present about 45 mixing plants are granulating a part or all of their products, and the number is increasing. In most of these plants a finely-divided mixture is agglomerated to improve the physical condition of the fertilizer. The annual U. S. production of granular mixtures is in the neighborhood of 1,000,000 tons and may approach 1,500,000 tons during the coming year.

There is no generally accepted definition of the term "granular" as applied to fertilizers. Currently, the particle-size range of commercially granulated mixed fertilizers is governed largely by manufacturing convenience and the attainment of improved physical condition. Ultimately, studies on the optimum particle-size for crop production as related to climatic factors, soil and crop characteristics, methods of fertilizer placement, and the degree of nutrient solubility in various types of mixtures may influence particle-size specifications for granular products.

Manufacturing convenience involves considerable variation among different fertilizer plants with respect to the conditions under which agglomeration occurs, the measures employed for controlling these conditions, and the handling of the fertilizer subsequent to its agglomeration. Differences in commercial granulation procedure may cause variations in particle size of the final product and in the distribution of nutrients among the different size fractions.

In order to ascertain the relative magnitude of these variations, screen analyses and chemical analyses of some of the sieved fractions were made on 29 samples representing granular mixed fertilizers now on the market in different sections of the country. One sample was a P-K mixture, 11 were N-P mixtures, and 17 were N-P-K mixtures.

Procedure

EACH sample, approximately one pound, was mechanically separated into size fractions by means of a series of 8-inch Tyler Standard Screen Scale sieves. (The respective sieves had 4, 6, 8, 14, 20, and 35, meshes per inch.) The sieve assembly was shaken for 10 minutes on a Ro-Tap machine.

Fractions whose weight equaled or exceeded 10 per cent of the entire sample were considered adequate for chemical analyses. In most samples the range of particle size was sufficient to permit the selection of one coarse fraction (4 to 6- or 6 to 8-mesh), one medium fraction (8 to 14- or 14 to 20-mesh), and one fine fraction (minus 14-, 20-, or 35-mesh). Where possible, alternate sieve fractions of the sample were chosen in order that variations in analyses would be defined more clearly. In some cases, only two fractions could be selected on this basis owing to the narrow range of particle size in the sample.

*A paper presented before the Seventh Annual Convention of the Association of American Fertilizer Control Officials, Washington, D. C., October 16, 1953.

The selected fractions were ground in a laboratory hammer mill to pass a 35-mesh sieve and analyzed for N, total and citrate insoluble P_2O_5, and K_2O. A. O. A. C. official methods of analysis were used.

Analytical Results

OF the 29 samples examined, 25 contained more than 50 per cent of 6 to 20-mesh material, 21 contained more than 60 per cent, 13 contained more than 70 per cent, and 7 contained more than 80 per cent. Eight of the 29 samples contained more than 30 per cent minus 20-mesh material and 9 contained more than 10 per cent minus 35-mesh material.

One sample, a mixture of granular ingredients, rather than a product obtained by granulating a mixture, had a preponderance of P_2O_5 in the coarse fraction and of K_2O in the medium fraction. Other samples, representing products obtained by granulation of mixtures, had each nutrient distributed to a considerable extent among the particles of different size.

There is a definite tendency, however, toward high P_2O_5 content in the coarser fractions and, in the case of N-P-K grades, high K_2O content in the finer fractions. Nineteen of the 29 samples containing P_2O_5 show a higher P_2O_5 content in the coarser fractions and 14 of the 18 samples containing K_2O show a higher K_2O content in the finer fractions. Variation among the different size fractions was not so marked in the case of nitrogen, probably because a part frequently is supplied as neutralizing ammonia which is more closely associated with the phosphate than are other nitrogen ingredients.

Table I shows the average particle-size distribution in the N-P, the N-P-K, and the combined N-P and N-P-K grades examined. The N-P grades and the N-P-K grades averaged 78 and 64 per cent, respectively, 6 to 20-mesh material, and 6 and 14 per cent, respectively, 20 to 35-mesh material. The amount of material larger than 6-mesh was about the same in both types of mixtures but on the average, the N-P-K grades were considerably higher in fines than the N-P grades.

Table II shows the average deviation of the individual plant nutrients from the stated grade of the N-P and N-P-K mixtures for the three size fractions studied. It also shows the deviation for the high-and relatively low-analysis groups of the N-P-K mixtures. Positive values indicate the units above grade found on analysis and negative values the units below grade.

The data indicate a general tendency for N to be more uniformly distributed among the different size fractions of the fertilizer than either P_2O_5, which accumulates in the coarse fraction, or K_2O which accumulates in the fines. The greatest deviations from grade occurred in the highest analysis N-P-K mixtures. In the nine N-P-K mixtures having the highest total nutrient content the P_2O_5 averaged 1.9 units above grade in the coarse fraction and 1.5 units below grade in the fine fraction. In the same mixtures K_2O averaged 2.9 units above grade in the fine fraction and 0.5 units below grade in the coarse fraction. The excess of above-grade deviations especially with respect to P_2O_5 and K_2O, probably is a reflection of overage allowances in manufacture.

Discussion of Results

IN general, the results indicate a fairly uniform distribution of nutrients among the various size fractions of present-day granular mixed fertilizers. Although the observed variations in nutrient contents of the different size fractions indicate that care should be taken to avoid segregation during sampling, the care required is probably no greater than that necessary to obtain representative samples of non-granular mix-

(Continued on Page 133)

Table I

Average Particle Size Distribution in Granulated Mixed Fertilizers

Particle Size	N-P Grades (11 samples)	N-P-K Grades (17 samples)	N-P + N-P-K Grades (28 samples)
Mesh	%	%	%
+6	13	12	12
6-8	28	16	21
8-14	42	35	38
14-20	8	13	11
20-35	6	14	11
-35	3	10	7

Table II

Average Deviation of Nutrient Content from Grade in Different Size Fractions of Granular Mixed Fertilizers

Fraction	Deviation, Units N	P_2O_5	K_2O
	N-P Mixtures		
Coarse	-0.5	+1.1	——
Medium	-0.4	+0.5	——
Fine	0	+0.9	——
	N-P-K Mixtures		
Coarse	-0.1	+1.1	-0.5
Medium	+0.1	+0.1	+0.5
Fine	0	-0.4	+2.2
	N-P-K Mixtures Averaging 26% Total Nutrient Content		
Coarse	-0.2	+1.3	-0.6
Medium	+0.1	+0.1	+0.2
Fine	+0.4	+0.4	+1.4
	N-P-K Mixtures Averaging 41% Total Nutrient Content		
Coarse	-0.1	+1.9	-0.5
Medium	+0.2	-0.2	+0.8
Fine	-0.3	-1.5	+2.9

A.C.S.

Division of Agricultural and Food Chemistry Hears Talks on Pesticides at Kansas City Session

TECHNICAL papers on toxicity and safe handling of pesticides, analysis of systemics, formulation of insecticides and fungicides, performance of chemicals in the field and new application methods were presented to members of the American Chemical Society at a meeting of the Division of Agricultural and Food Chemistry of ACS at Kansas City, Mo., March 23 to April 1.

The papers were presented at meetings of the pesticides subdivision and at a symposium on mechanical and engineering aspects of pesticide application.

Members of the Division met in the city's Municipal Auditorium to hear the papers. Following are abstracts of some of the reports which should be of particular interest to members of the pesticide industry:

Formulation of Pesticide Dry Concentrates and Dilute Dusts. *John F. LesVeaux, Harry West, Carroll C. Cassil and Frank S. Black, Niagara Chemical Division, Food Machinery & Chemical Corp., Middleport, N. Y.*

A discussion of the basic concepts involved in the formulation of agricultural pesticidal dusts and wettable powders. In order to prepare satisfactorily an efficient agricultural pesticide from a technical grade chemical compound, several factors must be considered. The effect of such factors as concentration of toxicant, type of inert selected, ultimate particle size of formulation and application equipment to be used on the efficiency of the final product should be considered.

Equipment for the Commercial Manufacture of Pesticide Formulations. *Merwyn D. Riddle, Heckathorn & Co., Richmond, Calif.*

The equipment used for processing technical pesticides into usable form is discussed. Various types of grinding and mixing equipment being used in the industry are described. Special emphasis is put on equipment used in fine grinding.

Composition Analyses of Technical Grade Materials and Formulated Products Containing Pesticides. *F. A. Gunther and R. C. Blinn, University of California, Citrus Experiment Station, Riverside, Cal.*

In general, analytical methods for the quantitative determination of major pesticidal components in technical grade materials and formulated products are to be regarded as macromethods as contrasted with micromethods commonly utilized in residue investigations. Thus, the macrosample is not limited in size or weight and the ratio between total extractives and ingredient of interest is low - e.g., 1.2 to 1.0. It would seem, therefore, that such composition analyses should be fundamentally more precise and less troublesome than residue determinations, where the above ratio may approach 50,000 to 1. This indication is not generally verified, and reliable results from composition analyses are achieved laboriously and with difficulty. The many reasons for these difficulties are developed in the discussion.

Pesticide Formulations as Related to Field Performance. *N. F. Hardman and H. O. Thomas, Jr., Agricultural Research Laboratory, Stauffer Chemical Co., Mountain View, Cal.*

The effectiveness of insecticides in the field is dependent not only upon the inherent toxicity of chemicals but also upon their preparation before application. Chemical properties of diluents, liquid or solid, may be such that reaction with toxicants occurs with reduction of effectiveness. Emulsifiers, wetting agents, dispersing agents, and adhesive agents must be compatible with toxicants and diluents.

Physical characteristics of diluents are equally important. Diluents and surfactants in spray formulations may increase the effectiveness of toxicants by increased wetting of the pest and by increasing the rate of penetration into the pest.

The residual effectiveness of a toxicant is dependent not only upon the chemical stability to heat, radiation, moisture, and the surface applied, but also upon loss by volatilization, wind and water erosion, and solution. Loss by chemical breakdown and volatilization proceeds at increased rates as subdivision of particles is increased. However, initial effectiveness is usually higher when particles of toxicants are smaller. Increased ease of "pick-up" of smaller particles from residual deposits by pests crawling upon the treated surface affords an explanation in part of greater effectiveness of smaller particles.

Fungicide Formulations as Related to Field Performance. *J. D. Wilson, Department of Botany and Plant Pathology, O. Agricultural Experiment Station, Wooster, O.*

Because few fungicidal compounds are capable of giving a maximum of disease control in their initial state, it is essential that they be formulated for field use. Virtually all of our present-day fungicides are insoluble in water and many are also nonwettable. Thus the powder forms must be made dispersible and any nonmiscible liquids must be made emulsifiable. It is also essential that insoluble powders be finely ground to give them a maximum of adhesion and coverage.

In formulating a fungicide for field use, additives must be chosen that are sufficiently compatible with the active agent that there will be no decrease in fungicidal efficiency, stability, or adhesion and no increase in phytotoxicity. The physical and chemical character of the formulation will of necessity be determined to a considerable extent by such factors or considerations as: what will be the most practical percentage of active ingredients, whether it is to be prepared for use as a powder or a liquid, whether it will be applied in a dilute or concentrated formula, whether it will be necessary to use any type of wetting, adhesive or suspending agent, and what the physical and chemical characteristics may be of any needed diluents, carriers or conditioning agents.

Finally, the manufacturer or processor should consider the possibility that an insecticide formulated as a wettable powder or an emulsifiable concentrate

(*Turn to Page* 137)

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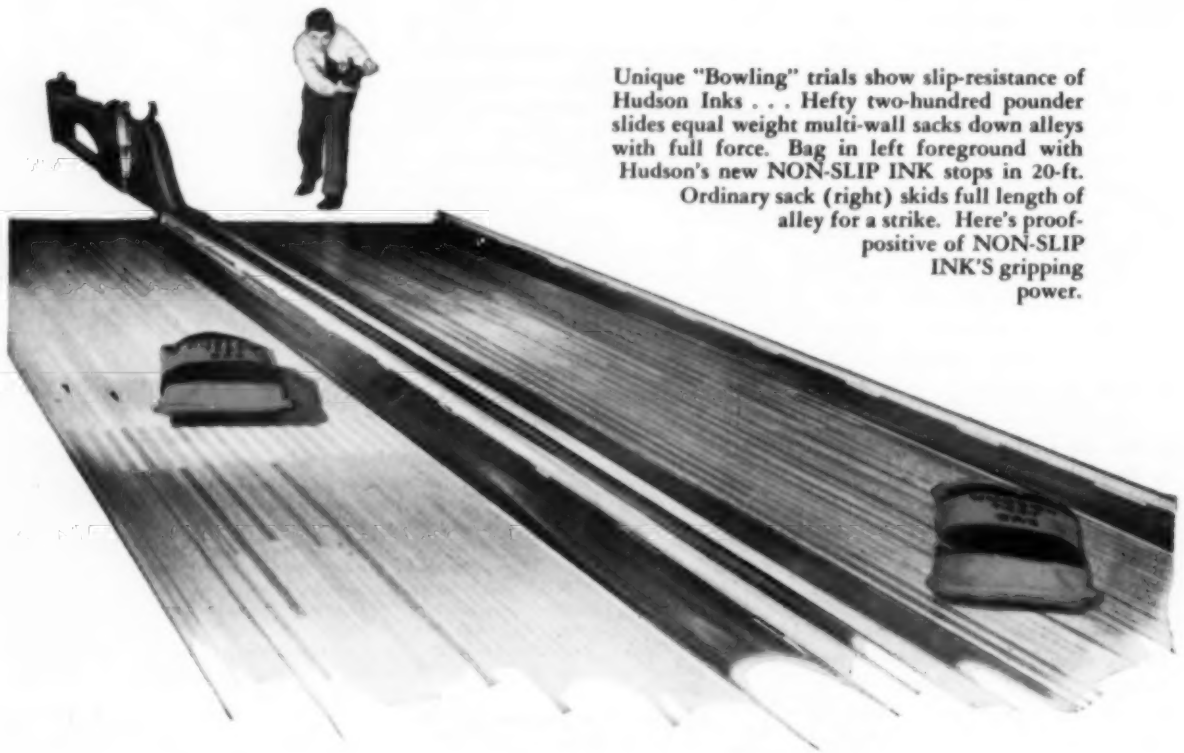

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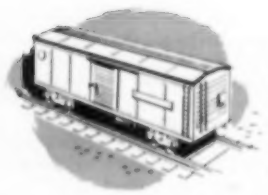

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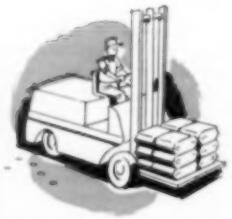

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WASHINGTON *Report*

by
Donald G. Lerch
Cornwell, Inc., Washington, D. C.
(Agricultural Chemicals Washington Correspondent)

AN intensive check on Congressional opinion shows the general expectation that the Miller Bill (H.R. 7125) will probably become law by summer. And if it does, the insecticide industry then faces the task of continuing its work with government agencies, agricultural groups and experiment stations with the goal of putting the law into operation during 1955. Passage of the measure would herald the beginning of a new climate in pest control.

As Congressman Miller (R. Neb.) sees it, the law would be a workable piece of legislation, "under which all groups, government, industry and governers can satisfactorily operate, and at the same time give increased protection to the public health." Congressman Miller also emphasizes that the measure, "recognizes that questions of an agricultural nature and the establishment of usefullness is a function of the Department of Agriculture and, therefore, it should be their responsibility. This brings the legislation we are now discussing more closely into the Federal Fungicide and Insecticide Act of 1947 which is administered by the Department of Agriculture."

This statement by the author of the measure is perhaps most significant. It recognizes the importance of an agricultural approach to many of the problems arising from the use of insecticides. In effect it places more responsibility on agricultural men.

Those who have followed the whole matter closely during the past four years know this has not always been the case. In fact, some of the earlier thought given the problem advocated removal of jurisdiction from agriculture whenever possible.

The proposed law also gives clear cut authority to the Food and Drug Administration to establish workable tolerances where needed. Congressman Miller states specifically that, "the present laws are bulky and cumbersome and do not lend themselves to efficiency, with the end result being the American people are NOT being afforded the protection due them."

With thousands of agricultural chemicals on the market, used under tremendous variation in conditions, a lot of people will be rolling up their sleeves. It looks as though summer time is going to be a busy time.

* * * * *

Paul Mayfield, NAC president makes a special point of the attitude of the industry toward self regulation. "In answer to public criticism of the rise in the use of pesticides in protection of crops, I wish to emphasize that NAC and the industry are on record for the second time in one year in endorsement of legislation in the public interest to further protect a safe food supply. . . . Most of the provisions of the proposed legislation are already being met by industry, but the endorsement recognizes the necessity for spelling out in detail in the law the principles which have been practiced during the past several years."

Mr. Mayfield also, recognizes that the welfare of industry's customers, the farmers, is of prime importance. This law would aid the farmer, Mayfield observes, because when the manufacturer's recommendations are followed, there would be no fear of seizure by a government agency.

As far as residue hazard is concerned, farm families have just as much at stake as families in the city, because they also buy most of their food. The age of self sufficient farms may not be past, but it is a dim memory in many rural households today.

In fact, the increased use of agricultural chemicals, which makes possible higher and higher yields, is at the same time forcing more specialization. As a farmer invests more cash in a crop in terms of seed, fertilizer, and insecticides, he spends more time as a manager. Often, the more time he spends managing, the more money he makes. So, he too buys food at the corner store and super market. The health of his family is of great importance. Ask him.

* * * * *

Fertilizer industry officials feel there is a quieting effect in the new report that nitrogen production could well top the government's 1957 goal by nearly 10 percent. This is in sharp contrast to some government figures which claimed a shortage would be pending by then.

Of Course, it all depends on how you define a crisis. In a war, there's rarely enough of anything . . . surpluses become shortages overnight. However, in this case the industry has come up with figures showing that by applying good 'ole American ingenuity to the use of its physical facilities, it can equal and exceed what has been established and recognized as a practical goal.

All of which could mean there is a lot of fuss for a few favorite sons.

* * * * *

Just one week after the Miller Bill cleared its first Congressional hurdle, Congressmen were treated to a newspaper account telling of injury

to a boy in Oregon who accidentally spilled the insecticide TEPP on his leg. The account went on to blame lack of sufficient evidence on its toxicity as a factor delaying proper treatment. The report indicated the material was properly labeled.

The implication that a product would be marketed without sufficient knowledge of its toxicity and how to treat it is the most unfortunate part of the report. This single factor is probably the cause of the widespread publicity given this report.

In the newspaper and public relations fraternities the movement of a story over a wire service from coast to coast is a feat in itself. In fact a good many thousands of dollars are often spent by skilled technicians in creating news on one coast and building fires to have it transmitted to the other coast. This "pull through" over a wire service means that the hundreds of newspapers subscribing to the service enroute have the story deposited automatically in their laps. This particular story moved on the Associated Press.

To move a story coast to coast means it has competed successfully with hundreds of other news items. Admittedly Monday, the day this story moved, is often a light news day. However, depending on editorial judgment of what is news, there is little in this story to cause it to receive even a second glance except the compelling element—fear of the unknown.

The fact is that scientists are agreed that enough is known about this chemical so that its effects can be treated. Furthermore, this information has been disseminated. If, however, as reported in this particular dispatch, the people on the scene did not feel they had sufficient information, then there is a problem which requires immediate attention by the industry and scientists everywhere.

Surely, after industry has invested the money necessary for toxicological investigations, no one should suffer or be frightened because an unknown assailant lurks "in waiting." Yet the potency and spectacular results from the use of insecticides is enough to stir everyone's imagination, particularly the uninformed.

The only way to combat fear is by knowledge. And knowledge by itself means little unless it is in the minds of the people concerned. Recent events show clearly that this includes the press and radio as well as scientists and general public. Concerted industry-wide effort is needed to meet this problem before it becomes an "epidemic."

* * * * *

Ask farmers about controlling flies in the dairy barn and lots of them just throw up their hands. Maybe I've been talking to the wrong farmers, but the fly problem is put at the head of the list of insect troubles by most of the men I've talked to.

The problem has resulted in so much mail coming into the U. S. Department of Agriculture offices that some officials have resorted to mimeographed letters. The significant thing is that most of this mail coming to the government is from INDIVIDUAL farmers — not groups or organizations or companies.

Reason for some of the mail is believed to be the popularized reports of research on poison baits carried in the general farm press and on farm radio. This is just another way of saying that word has gone out to farmers that poison baits may help answer their fly problem.

But news of all kinds of research is constantly being fed to the press and radio. What isn't fed is scooped up by enterprising journalists and reporters who are often aided in their search as part of legitimate government activity, on the basis that research should be translated into practical application if at all possible. And one way to do this is to tell people what it is that has been discovered.

So, the mere fact that farmers have been exposed to news about poison baits is in itself not unusual. What is significant is the voluntary response—the deluge of mail asking for details.

USDA scientists are now putting finishing touches on a circular covering this topic. Question is where to cut off and go into print. The demand for information is there and the government must act.

In the opinion of many farmers nothing yet put on the market equals the ease and results achieved in fly control that was experienced immediately after World War II. Consequently, farmers are difficult to satisfy.

A by-product of the fly control problem is its effect on the farmer's opinion of other insecticides. To how great an extent may his opinion of all insecticides, for instance, be conditioned by the results he obtains in fly control? This might be worth looking into.

* * * * *

Curacao, a 200 square mile island about 40 miles off the coast of Venezuela is the scene of current U. S. research on screw worm control. Some of the Beltsville scientists working on the project hope to have some clue as to the effectiveness of their efforts in the next few months.

It took some time to select the island, because of the exacting requirements of the experiment. The normal existence of the screw worm was one essential. Another was sufficient remoteness from other land so that the fly population could be kept isolated and results measured. Cooperation of the government involved was of course another requirement.

Since the female mates only once, it has been demonstrated in laboratory cages that the flies can be forced to commit "race suicide." Under controlled conditions it all works out beautifully. The big question is—under field conditions will results be equally successful? . . . The Curacao experiment means that we shall soon see.

* * * * *

USDA officials are anticipating many accomplishments from the increasing development and use of antibiotics for the control of bacterial diseases. The effective systemic action of antibiotics holds great promise for the future, they believe. The development itself is not news. What

(*Continued on Page* 149)

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LISTENING *Post*

2,4-D Injury; Wheat Germination; Head Smut Control—Reviewed

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Plant Disease Survey Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, Beltsville, Md.

By Paul R. Miller

E. R. de Ong of Albany, California, reports that injury to lettuce has been found over extensive areas in the Salinas Valley of California, from the use of spray rigs that had previously been used for applying "low volatile esters" of 2,4-D. Immediately following this use the tanks, nozzles, and boom were rinsed three times with cold water, one rinsing being alkaline. The lettuce is the heading type of one or more of the commercially grown types. The different fields varied in age from three to five weeks when sprayed.

Two of the spray rigs, after being rinsed, were used the next day for spraying lettuce with the insecticide DDT and Metacide, which had been dissolved in organic solvents and then emulsified. The third rig was not used until several days later for applying the same formula of insecticides. Every field of winter-seeded lettuce, where spray rigs with a 2,4-D record had been used, was a complete loss. A springseeded field that received a late application of the same insecticide formula may show some marketable lettuce. Other lettuce fields that were sprayed with the same insecticide formula by rigs without a 2,4-D record made a normal growth.

Symptoms of injury included twisted, distorted leaves, failure to form a solid head, and the formation of loose, peaked heads. Lettuce harvest that had begun in one field was stopped by the shipping inspector because of the increased tendency to break down from "slime mold." This term is applied to a form of soft rot especially noticeable in heads that have been injured by frost, downy mildew or other causes. Symptoms of injury to weeds in the treated fields included rounded or cupped leaves on lambs quarter and pleated or fanlike leaves on mallow.

Two factors are of especial importance in this case. The damage has been so extensive in its distribution that further restrictions are probable in the use of equipment with 2,4-D history for any other purpose whatever. Second, additional emphasis has been laid on the persistence of 2,4-D in tanks, booms, and nozzles and the danger that organic solvents in later formulations will take up the hormone compounds present in amounts very small, but still sufficient to be dangerous to susceptible crops.

Germination Tests On Treated Wheat Seed

ALVIN Overland and W. L. Nelson, of the Washington Agricultural Experiment Station, report that winter wheat seeded in Lincoln County, Washington in the fall of 1952 germinated and emerged during the month of January, 1953. The temperature during the time of germination and emergence was about 5°C. The stands in many fields were poor and irregular, and it was noted that most of these fields were from seed that had been treated with copper carbonate by the slurry method. This suggested that copper carbonate, applied as a slurry, decreases the viability of wheat seed.

Samples of seed were obtained from two local seed processing plants, one of which had used the dust treatment, and the other the slurry treatment. Samples of untreated seed were obtained to be used as a check. Samples of both treated and untreated seed were from lots of seed distributed to farmers. The seed had been treated at the recommended rate of 2 ounces per bushel.

Two germination tests were made at different times, in the Seed Laboratory at the State College of Washington. An attempt was made to simulate field conditions, by subjecting part of the seed to a cold treatment. This treatment consisted of placing the seeds on moist blotters in petri dishes, and storing in a refrigerator held at 3°C. for a period of 19 days in one test and 11 days in a second test. The petri dishes containing the seeds were removed from the refrigerator to room temperature for an average of several hours each day. The period of exposure to room temperature was about an hour per day at first, and then increased to four or five hours toward the end of each test. The wheat was then transferred to a germinator maintained at a temperature of 20°C. This temperature is standard for germinating wheat.

A comparable germination test was made with seed not subjected to the cold treatment. Preliminary sprout counts were made after five days, and final counts after ten days. Only normal healthy sprouts were recorded. Percentage of germination was calculated on the basis of 100 seeds planted, each planting being replicated two and four times respectively, in the first and second test. The results are presented in Table 1.

TABLE 1

Results of germination tests with winter and spring wheat seed treated with dry and slurry forms of copper carbonate, showing a differential effect on viability of the seed germinated at 20°C.

	Percent[a] germination at indicated fungicide and temperature treatments					
	Check		Dust		Slurry	
Variety[b]	3°C. exposure[c]	20°C.	3°C. exposure	20°C.	3°C. exposure	20°C.
Elgin	98*	95	91	95	73	77
Elmar	93*	92	89	93	53*	77
Turkey	95	95	90*	96	75	83
Hymar	87	90	96*	93	37*	79
Federation	98	93	96	94	85	83
Idaed	90	93	—[d]	—	87	86

[a]Average of two separate tests, except that asterisk denotes figures for one test only.
[b]The last two listed are spring wheats.
[c]The seed was incubated at 3°C. for 11 to 19 days prior to incubation for germination at 20°C.
[d]No test.

As shown in Table 1, (above) wheat treated with slurry copper carbonate gave lower percentages of germination than untreated seed or seed treated with copper carbonate dust. In the first test, the reduction in germination from copper carbonate slurry—treated samples was more marked at 3°C. than at 20°C. However, at both temperatures, germination of wheat treated with copper carbonate slurry was markedly less than that of either untreated seed or

(*Continued on Page* 141)

Corn Borer Figures Released - Fruit, Veg. Pests Discussed

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Mr. Dorward is head—Economic Insect Survey Section, Plant Pest Control Branch, U. S. Department of Agriculture, Washington. His observations are based on latest reports from collaborators in the U.S.D.A.'s pest surveys throughout the United States.

By Kelvin Dorward

IN a recent release compiled by Mr. R. L. Shotwell of the Section of Cereal and Forage Insect Investigations, the estimated loss caused by the European corn borer to the 1953 corn crop grown for grain was about 90,000,000 bushels, which is equivalent to over 3 per cent of an estimated national crop of 2,869,636,000 bushels. The estimated dollar loss is $125,466,000 based on value received by the farmers as of December 15, 1953. The estimates were made for 1,008 counties in 26 States and include 65 per cent of all the counties known to be infested in the United States. The 1952 loss was over $3,000,000 bushels valued at $77,209,000.

Small Grain Pest Outlook

SURVEYS conducted during recent months by Federal and State entomologists in Texas, New Mexico, Oklahoma and Kansas indicate that no general widespread grain insect outbreak is in prospect for the four-state area.

Some locally heavy infestations of brown wheat mite may develop within the near future in the Texas Panhandle, western Oklahoma, Oklahoma Panhandle, and southwestern Kansas. A few fields in all four states have been found that appear to have a threatening infestation of cutworms, but the infestation is not general. The most severe greenbug infestation appears to be localized in Payne County, Okla. Several fields throughout Oklahoma have very heavy populations of the English grain aphid and the apple grain aphid, but these insects usually do not cause severe damage. However, if the English grain aphid persists until April and May and infests the developing heads, additional damage may occur. A wheat curl mite has been found in a high percentage of wheat samples that were brought into the greenhouse from the northern half of Kansas during the fall of 1953.

By the middle of March, greenbug populations as high as 200 per linear foot were found in south Payne and Logan Counties, Oklahoma, but by the latter part of the month the infestations were declining primarily due to parasites and predators. Earlier in the month some chemical control measures had been used. Light populations were reported from Ellis, Roger Mills, Dewey and Blaine Counties, Oklahoma. The first report of greenbugs in Kansas was received the last of March with a very light infestation having been observed in barley in Anderson County. None were found in fields examined in Central Kansas Counties. In Mississippi, greenbug infestations on oats were observed or reported to be over the southern half of the State.

Armyworms, which in 1953 caused extremely heavy damage in some central States, are now active in the South. Heavy flights of moths have been noted at light traps in Tensas Parish, Louisiana, lighter flights in East Baton Rouge and Madison Parishes. Earlier, a moderately heavy infestation of mostly mature larvae in wheat and oats had been reported from Arcadia Parish. A medium infestation of armyworms on clover and alfalfa at Weimar, Colorado County, Texas occurred early in March.

Alfalfa weevil adults by late March were showing activity in eastern Maryland. It will be recalled that these insects were first reported in the Eastern States in 1952. Weevil activity was also becoming noticeable in several Utah Counties.

Fruit Insect Conditions

THE peach tree borer infestation throughout the peach belt of Georgia is reported to be on the increase, believed primarily due to ineffectiveness of sprays. A heavy local infestation of the borer was reported

from near Lindale, Smith County, Texas.

In the Kearneysville, West Virginia, area, the number of codling moth wintering larvae under tree bark is reported to be about normal but the survival percentage is relatively high. Also in that area, the wintering females of the woolly apple aphid are numerous and widespread. Forbes scale is also widespread, but the intensity is probably less than in 1953. Spider mites are probably less than normal with some hatching of *Bryobia* sp. having taken place about the middle of March.

Aphid infestation on Florida citrus was not expected to reach its peak before the middle of April. Hatching of purple scale in that State was slowly increasing, with the peak expected in April. In Arizona, spider mites were severe enough in some groves to warrant control. In Louisiana, there was a general infestation of Eastern tent caterpillar throughout the State on wild cherry, peach, plum and hawthorn.

Boll Weevil Survival Counts

TRASH examinations to determine the winter survival of boll weevils were completed in Madison Parish, Louisiana, March 4, 1954. Mr. R. C. Gaines, of the Section of Insects Affecting Cotton and Other Fiber Plants, reported that the number of live weevils per acre, found per examination point, ranged from 0 to 6,050 with an average of 1,113. This average was about 1.4 times that found in Madison Parish during the past 18 years. There were only five years (1945, 1949, 1950, 1951 and 1953) of the past 18 when the average per acre was higher. The number surviving this spring was 21 per cent of the number found in hibernation last fall. The survival this year was approximately one-half of the average survival during the past 17 years.

Fall hibernation counts for Florence County, South Carolina have been received from Mr. R. L. Walker of the above-mentioned section. During the fall of 1953, surface trash from 10 farms in Florence County was examined and an average of 3,533 live weevils per acre was found. This compares with 6,259 per acre in in the fall of 1952 and an over-all average for 11 years of 4,541. Only in 1943 and 1951 were fewer hibernating weevils found.

Previously reported fall hibernation counts in McNairy County, Tenn. showed a very heavy reduction in 1953 as compared to 1952. In Georgia, the counts were slightly higher than the previous year.

Vegetable Insects

ACCORDING to a recent report by Dr. H. E. Dorst and Dr. G. F. Knowlton on beet leafhopper conditions in some of the western States, the beet leafhopper spring movement from the southern desert breeding areas to the cultivated areas of north and central Utah and western Colorado is expected to be light. The local movement in north and central Utah and in western Colorado is also expected to be light as is the movement to southern Utah, southern Nevada, southeastern California and central Arizona. The overwintering population in the southern breeding area is considered to be approximately one-sixth as large as that which occurred in 1953. Spring host plant conditions are unfavorable for leafhopper breeding in most portions of the southern breeding grounds. The acreage of host plants is only about one-third that of 1953. In the local breeding areas of northern Utah, a light population of leafhoppers entered the winter under unfavorable conditions. The condition and stand of spring host plants in the uncultivated areas in most cases is unfavorable. The movement of the leafhoppers into the cultivated districts of central Utah and western Colorado is expected to start by mid-April. Weather of course is a dominant factor. When an early spring follows a mild winter, it usually advances the date of beet leafhopper movement from the uncultivated breeding areas to the cultivated districts. A late spring with excessive rainfall delays the date of the movement.

Various insects which were of concern to vegetable growers during March were: Aphids on lettuce in Maricopa County, Arizona, on collards and winter kale in the Norfolk, Virginia, area and on cabbage and turnips in several Georgia Counties; false chinch bug on vegetables in general in the Rio Grande Valley of Texas, on turnips near Livingston, Texas and in Kemper County, Mississippi; and spider mites which were damaging onions near Phoenix and watermelons in the Yuma, Arizona, area, heavy on strawberries in St. Tammany Parish, Louisiana and light on the same host in the Norfolk, Virginia, area. On strawberries in the Dade County, Florida, area mites averaged 12 per leaf.★★

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Garden Show Dates Announced

Following dates and locations for its 1954-55 Trade Show series have been announced by Garden Supply Merchandiser magazine:

Oakland, Cal., Municipal Auditorium and Exposition, Sept. 19-22, 1954; Chicago, Hotel Sherman, Jan. 10-12, 1955 and New York, 71st Infantry Regiment, Feb. 1-3, 1955.

Plans are being completed for the Western States show in September, the magazine added. More exhibit space is being planned because of increasing interest in the field.

EDITORIAL

(*From Page* 33)

there is an element of strength in this situation for there seems less of a tendency on the part of sellers this season to push matters too hard, far in advance of the actual time when pesticides will be needed. Sellers seem willing this year, by and large, to let the market develop by itself,—and prepared to wait for it to develop. With very few exceptions, they seem determined this year to make a profit on what they do sell. As one practical formulator phrased this attitude, when interviewed by *Agricultural Chemicals*' representative in Houston last month, "I'd sooner go fishin' than kill myself another season, breaking my back to sell goods at no profit. At least I'd feel better fishin'!"

That is an attitude that could help turn '54 into a better profit year for the whole insecticide industry!

Technical SECTION

Explosion Characteristics of Insecticidal Aerosols

By A. H. Yeoman and E. R. VanLeeuwen

U.S.D.A., Agr. Res. Adm., Bureau of Entomology and Plant Quarantine, Beltsville, Maryland

IN the widespread use, during the last six years, of large insecticidal aerosol machines for indoor treatment, there have been several costly explosions in which houses, greenhouses, and even apartment houses were demolished. Some of these explosions are described in the National Board of Fire Underwriters Report No. 9, "Fire and Explosion Hazards of Thermal Insecticidal Fogging" 1952.

The information available on the explosion hazard of aerosols is limited. The conditions under which previous tests were made do not compare closely with those encountered in most aerosol applications. For this reason it was thought desirable to make some explosion tests under conditions as nearly as possible equal to actual treatment.

The CSMA drum test was chosen as the one best suited to our needs. It is described in "Test Methods for Checking the Flammability of Self-pressurized Containers," a bulletin prepared by the Aerosol Division Scientific Committee of the Chemical Specialties Manufacturers Association. The drum is a 55-gallon (9.4 cubic feet) open-head metal container laid on its side, fitted with a hinged cover over the open end, arranged so that it will open readily at a pressure of 5 pounds per square inch. The cover does not fit air-tight, and there is some leakage during the test. The closed end is equipped with a shuttered opening for introducing the spray. The opening that we used was 1-inch high in diameter and was located 2 inches from the top edge. Suitable windows were installed for observation. A burning plumber's candle was placed in the drum at equal distance from each end.

The explosive concentrations of various solvents and oils commonly used in aerosol formulations and the influence of particle size were determined by introducing known quantities of known particle size into the test drum until an explosion occurred.

The particle size of aerosols has been considered to be an important factor in flame propagation. Therefore, in these tests two ranges of particle size were used. An aerosol of approximately 15 microns MMD (mass median diameter), herein called a medium aerosol, was produced by means of a DeVilbiss Peet-Grady atomizer at an air pressure of 40 p.s.i. A finer aerosol of approximately 5 microns MMD, called a fine aerosol, was produced by spraying the liquids through an electrically heated iron core with a hole ¾-inch in diameter and 4 inches long.

In previous explosion tests[1,2] it has been shown that the percentage of oxygen in relation to that of the flammable material is important. Too much or too little oxygen will prevent explosion. Normal aerosol applications are made in enclosures filled with air, and during the applications only a small proportion of air is added. In the tests described a higher proportion of air was added than is usual in aerosol applications. This was necessary because of the quantity of air required to atomize the liquid. Owing to leakage of the drum, in which some of the aerosol is lost, the effect can be assumed to increase the contents of the drum by the volume of air added. In other words, if 10 cubic feet of air are needed to atomize the amount of liquid required for explosion in the drum, this amount of liquid can then be assumed to be explosive in 9.4 plus 10 cubic feet, or 19.4 cubic feet of space.

The results of tests with the CSMA drum method are presented in tables 1 and 2. (See Pg. 77)

[1] Sullivan, M. V., J. K. Wolfe, and W. A. Zisman. 1947. Flammability of the Higher Boiling Liquids and Their Mists. Indus. and Engin. Chem. *39*(12): 1607-1614.

[2] Burgoyne, J. H. and J. F. Richardson. 1949. The Inflammability of Oil Mists. Fuel *28*(1): 2-6.

Discussion

THERE was no difference between the fine and medium aerosols in the amount of volatile solvents required for explosion. However, for the oils and less volatile solvents, particle size had an important bearing.

The addition of a non-explosive solvent to an explosive one did not reduce its flammability until a 50-50 proportion was reached. This is demonstrated in table 2, where the equivalent amount of explosive solvent per 100,000 cubic feet remained constant until the point of no explosion was reached. This point is not clearly defined by these tests, since the large volume of air required for atomization in proportion to the amount of explosive material introduced may have been a limiting factor. One fact is evident from these tests—to raise the explosion concentration of a mixture it will probably be necessary to add at least 50 per cent of a non-explosive solvent.

The reliability of this method of testing is evidenced by the reproducibility of results, and the agreement with previous studies with other methods. However, it is necessary to compute the equivalent rate on the

Farmer Jones sets a good table

. . . and don't the insects know it!

BETTER CROPS mean mighty good eating for the bugs, too. But now, Shell Chemical provides *aldrin, dieldrin* and *endrin* . . . a team of potent insecticides that wipes out most any pest with a yen for crops. Boll weevils, cutworms, grasshoppers, rootworms, ants, hornworms, and a host of other hungry insects are knocked cold . . . above the soil or below.

Another Shell product, D-D®, goes underground to stop nematodes (parasitic worms no larger than these dots . . .) that attack many food, fiber and tobacco crops. ***One treatment controls nematodes for an entire season.***

All of these Shell insecticides are backed by State and Federal recommendations and the finest of technical service. They can be used and recommended with confidence. Technical literature is available.

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basis of the volume of the test drum plus the volume of air added by the process of volatilizing and introducing the aerosol. It is also necessary to avoid using an excessive amount of introduced air in proportion to the explosive solvent. Under certain conditions, where 50-50 mixtures were used, a flammable concentration is not built up in the drum, because the amount of explosive material per unit of air is too low. This limitation can be corrected by better methods of atomization which use less air.

Practical Application

IT is evident that aerosols containing solvents or oils of the types tested do not present an explosion hazard, if properly dispersed in a building at the usual rate of one gallon of formulation per 50,000 cubic feet of free air space. This rate for the entire formulation is only 1/18th the concentration of xylene, the most flammable of the materials tested, needed to produce an explosion.

Explosions that have occurred can therefore be explained only on the basis that a considerable overdosage occurred, probably by discharging the entire aerosol production of a large machine into a small room or confined area where an open flame or spark was present.★★

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Captan For Strawberry Rot

According to reports received by California Spray-Chemical Corporation, where formulations of Captan suitable for spraying and dusting use were developed and introduced under the name "Orthocide," growers who have used Orthocide in test areas of their strawberry acreage during the last three years credit the material with favorable results. Up to 66% greater yield for Orthocide-treated strawberry plots has been recorded in some sections of the country, and all testing areas have noted definite improvement in the control of Botrytis rot over materials used heretofore.

Label recommendations as to dosage—which are based on a nationwide average, read as follows:

Orthocide 5 dust:

Strawberries: Botrytis Rot—40 to 50 pounds per acre. Make first application when new growth starts in spring before fruit starts to form. Repeat these

Orthocide 50 Wettable

Under Severe Infection Conditions—Continue applications through harvest period, treating immediately after each picking.

Orthocide 50 Wettable

Strawberries: Botrytis Rot—2 lbs. to 100 gals. water, applying 200 diluted gallons per acre (or equivalent of 4 lbs. per acre in sufficient water for even coverage). Make first application when new growth starts in spring before fruit starts to form. Repeat these applications weekly. Under Severe Infection Conditions—Continue applications through harvest period, treating immediately after each picking.

These are "general" directions, however, it is advisable to consult farm advisors, manufacturers' representatives etc. for specific recommendations.

TABLE 1

Quantities of various solvents or oils required to produce an explosion in CSMA test drum.

Solvent or oil	Solvent required to cause explosion in drum		Air added to drum in atomization	Equivalent amount of solvent per 100,000 cubic feet
	Fine aerosol	Medium aerosol		
	Milliliters[1]	Milliliters	Cubic feet	Gallons
Volatile solvents:				
Xylene	18	18	3	39
Acetone	24	24	4	47.5
Cyclohexanone	32	32	6.5	54.5
Carbon tetrachloride	)			
Methylene chloride	)—[1]	—	—	—
Perchloroethylene[2]	)			
Oils and less volatile solvents:				
Sovacide 544C	25	—	7	40.5
(Socony Vacuum)	—	57[3]	15	62
Kerosene	25	—	4	49.5
	—	56	9	80
Deobase	25	—	4	49.5
	—	64	11.5	81
Texaco 300	23	—	7.5	36
(Texas Co.)	—	—[1]	—	—
Diol 50	35[3]	—	10	48
(Standard Oil)	—	—[1]	—	—

[1] No explosion with an application of 200 ml. or sufficient to extinguish the flame.
[2] Also known as tetrachloroethylene.
[3] No explosion in some replications.

TABLE 2

Quantities of mixtures of explosive and nonexplosive solvents applied as fine aerosols required to cause an explosion in CSMA test drum.

Mixture and proportion (by volume)	Mixture required to cause explosion	Air added to drum in atomization	Equivalent amount of explosive solvent per 100,000 cubic feet
	Milliliters	Cubic feet	Gallons
Deobase-perchloroethylene			
90-10	29	5	48
80-20	34	6	48
70-30	47	10	45
60-40	54[1]	14	37
50-50	—[2]		
Velsicol AR-60-perchloroethylene			
90-10	20	4	35
80-20	25	6	34
70-30	31	7	35
60-40	48	11	37
50-50	59[1]	14	34
Solvacide 544C-perchloroethylene			
90-10	22	4	39
80-20	26	6	36
70-30	32	8	34
60-40	45	11	34
50-50	—[2]		

[1] No explosion in some replications.
[2] No explosion with an application of 200 ml.

Herbicides for Vine Crops

Dr. R. D. Sweet and S. K. Ries of the N. Y. State College of Agriculture, Cornell, Univ., Ithaca, N. Y., conducting a series of tests on herbicides for their effect on yields and marketability, reported the following results in experiments on vine crops and beets:

For vine crops such as muskmelons, watermelons, cucumbers, they suggest N-1 Napthyl phthalamic acid (Alanap-1) on a *trial basis only* as a control for annual weeds in their seedling stage. (Some varieties of squash and pumpkins react unfavorably to this treatment, so until more experiments are completed phthalamic acid should not be used on these two crops.) The acid will kill germinating seedlings only. For this reason it is useful shortly after planting or after clean cultivation and will not harm the crop when applied at correct rates. 2 to 4 lbs. of phthalamic acid (Alanap-1 is a 90% wettable powder) are used in 30 to 100 gallons of water. The mixture should be agitated during application, and best weed control will occur when soil is slightly moist. NOTE: Until additional research is conducted, Cornell recommends only *one* application to any given crop.

Pigweed and lamb's quarters in beets appear to be particularly well controlled by applications of C.M.U., although it will not control perennial weeds. Dr. Sweet notes that experiments this past summer indicate that C.M.U. should not be sprayed on beets planted in light, sandy land—soil low in organic matter. The recommendation is ⅜ pound of 100% C.M.U. in 30 gallons of water applied any time before the beets come up. Measurements should be especially accurate with C.M.U. and it is suggested for *Trial Use Only* until further research is concluded. *Market Growers Journal*, p. 12, Feb. (1954)

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Spray Applications of Polybor

It has been found that spray applications have certain advantages over soil applications. These advantages include a more equitable distribution, that is, less material is applied to smaller trees; it is easier to apply very small amounts. Annual applications may be made, avoiding too much one year and too little the year before an application is made. Since sodium pentaborate (also sold under the trade name of Polybor) has become available especially formulated for spray application, this is preferred over the soil application. Sprays may be applied at any time with early season foliage applications preferred. Polybor applied at a rate of five pounds per acre annually seems to be adequate to maintain a normal state of boron nutrition.

Excessive applications of boron are toxic to trees. Many young trees in boron-deficient areas have been severely injured or killed from one-half pound boric acid per tree applied within a few feet of the tree. Injury to young trees can be avoided if spray applications are made, using one pound of sodium pentaborate (Polybor) per 100 gallons of water. *Western Fruit Grower*, October 1953.

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Stored Grain Loss Studies

Losses in stored grains caused by the Angoumois grain moth may be reduced if varieties which are more resistant to the development of the insect are grown. This is the finding of a research project by L. Warren, Kansas State College.

In all, Warren tested 29 single cross open-pollinated corn hybrids and 22 sorghum varieties. Among the corn hybrids, Warren found inbreds 38-11 and K705 least favorable to the development and growth of the Angoumois moth, as determined by such things as weight of adults, duration of immature stages, percentage of larvae surviving as adults, and rate of egg laying by the moth.

Sorghum varieties least favorable for development of the moth were Early Kalo, Early Sumac, Texico 63, and Combine White Kaffir.

The effect of an increased amount of moisture on the development and growth of the grain mother was apparent throughout the study. Warren's work is important in light of emphasis being given production of grain free from insect attack.

Insecticide Corrosion Studies

A series of 28 agricultural chemicals used in corrosion studies were found to have an adverse effect on most metals and coatings. Type 302 stainless steel and polyester plastic reinforced with fibrous glass were found to resist completely all solutions investigated; but monel metal is said to have only reasonably good resistance. Brass, aluminum alloy and chrome molybdenum are adversely affected by the insecticide solutions.

The experiments are one phase of the general agricultural aviation research program at the Texas Engineering Experiment Station. Insecticides included in the tests are: TEPP, toxaphene, "Aldrin," "Chlordane," DDT, parathion, "Dieldrin," "Aramite," and BHC.

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Oligomycin for Plant Disease

Research at the laboratories of the University of Wisconsin has resulted in the isolation of the drug oligomycin, an antibiotic said to show promise in plant disease control. It is reported that this drug seems to be effective against many plant disease fungi, yet does not harm bacteria. It is said also to maintain its activity over a wide range of pH and temperature conditions.

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Mfg. of Copper Oxychloride

A process for manufacturing $3CuO \cdot CuCl_2 \cdot 4H_2O$ is described in a recently issued British patent #660,216. The product is reported to have plant-protecting properties.

Washed cuprous oxide is treated with a solution of hydrochloric acid, ferric chloride, zinc chloride, manganese chloride, aluminum chloride, or magnesium chloride in a ratio of .5 chlorine atom per atom of copper. A finely divided oxychloride free of electrolyte is produced. It forms stable suspensions which give lasting coatings on plant leaves. The copper oxide used is produced either by precipitation of metallic cupper in air or by precipitation of a copper salt solution or copper oxychloride suspension with calcium hydroxide of sodium hydroxide.

Endrin Controls Cotton Insects

One of the newer organic insecticides, endrin, has been found to be the best insecticide thus far tested against the combination of the bollworm and the boll weevil, two of cotton's most destructive insects. Entomologists of the U. S. Department of Agriculture find that endrin also gives control of several other cotton pests but not of the pink bollworm or of spider mites. Endrin has a longer-lasting residual action than toxaphene, the only other insecticide recommended for control of both the boll weevil and bollworm.

Endrin is toxic not only to insects but also to man and other warm blooded animals; and users are cautioned to follow exactly the recommendations of the manufacturers which are printed on the label of the insecticide container.

Endrin is closely related chemically to dieldrin, one of the cotton insecticides widely used at present to control the boll weevil. Endrin has been tested by USDA's Agricultural Research Service entomologists under the widely divergent cotton-growing conditions found at locations such as Florence, S. C.; Brownsville and Waco, Texas; Tallulah, La.; and San Fernando, Tamaulipas, Mexico. At Florence, endrin-treated plots yielded gains in seed cotton of up to 746 pounds an acre. In Mexico, use of endrin increased the seed cotton yield 1,071 pounds an acre during a heavy boll weevil infestation.

With cautious optimism entomologists state that the new material comes closer to being an all-purpose cotton insecticide than any yet tested. Applied in quantities varying from 0.2 to 0.5 pound per acre, it is effective against the boll weevil and bollworm. At the rate of 0.1 to 0.2 pound per acre it is effective against such other cotton pests as thrips, cotton leafworms, cotton fleahoppers, and lygus bugs.

NEW BOOKS

Growing Fruit and Vegetable Crops by T. J. Talbert. Published by Lea & Febiger, Philadelphia, Pa. 350 pages, 6 x 9 inches, cloth binding, $4.50.

Fundamentals which influence and determine successful fruit and vegetable culture are discussed in this text which considers each crop individually. The book includes also chapters on diseases and insects, and sprays and spraying; and windbreaks and cold injury. Sprinkler systems as a means of modern irrigation are given special consideration in both text and illustration. More than 70 photographs and sketches illustrate the book.

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Soils and Fertilizers by Firman E. Bear. Published by John Wiley & Sons, Inc., New York. Fourth Edition. 420 pages, 6 x 9 inches, cloth binding, price $6.00.

This fourth edition of Dr. Bear's well known text brings up to date information in the field dealing with soils in relation to crop production. Applications are made of those facts of use in planning constructive systems of managing soils and increasing their productive capacities. The text is directed toward readers familiar with geology, chemistry, physics and botany, and the vocabularies of these sciences. However, the author points out that the more advanced phases of soil science are not touched upon.

Included are chapters dealing with plant growth; soil composition, classification, requirements, physical properties, conservation etc; resources of nitrogen, phosphorus, potassium, calcium, etc; mixed fertilizers, selection and use of fertilizers; yield potentialities of crop plants.

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Leaders in American Science edited by Robert C. Cook. Published in Nashville, Tenn. 6 x 9 inches, 852 pages, cloth binding, price $12.00.

This test lists biography and pictures of 13,500 leading scientists in higher education, business and industry, governmental services and private research. Among the fields covered are: agricultural research, horticulture, pathology, physiology, etc.

Literature Available

The following list reviews a series of bulletins on fertilizer, insecticide and fungicide recommendations, controls, etc. For the most part, these bulletins and reports are prepared by the various state agricultural experiment stations, and copies may be obtained by writing directly to the respective stations.

HOW TO CONTROL WIREWORMS by A. A. Granovsky. 4 pp. Review of life history of wireworms, damage they do, and control by cultural practices. Recommendations of control by insecticides and other chemicals are also given. Extension Folder #170. Univ. of Minn. Inst. of Agric., St. Paul, Minn.

ANNUAL REPORTS ON COMMERCIAL FEEDS, COMMERCIAL FERTILIZERS AND AGRICULTURAL SEED INSPECTIONS—1952—60 Pages Bulletin #485, Montana Agric. Exp. Sta., Bozeman, Monta.

METHYLENEDIOXYPHENYL SYNERGISTS FOR INSECTICIDES. Bulletin 570, Conn. Agr. Exp. Sta., New Haven, Conn.

PHOSPHATE FERTILIZERS. 36 pp. Efficiency of various phosphates for row crops, pasture and forages; description of materials rates of phosphate for row crops and pastures; colloidal, rock and superphosphate comparisons; residual effect, etc. Bulletin #503. Mississippi State College Agri. Exp. Sta., State College, Miss.

SEASONAL DEVELOPMENT OF RANGE GRASSHOPPERS AS RELATED TO CONTROL by R. C. Newton, C. O. Esselbaugh, G. T. York, and H. W. Prescott. 18 pp. Bulletin E-873, USDA, BEPQ.

RESEARCH AND FARMING 16 pp. Liquid soil conditioners; tobacco crops; new hay drier described; peach problems discussed. Autumn edition of North Carolina State College, Raleigh, N. C.

OFFICIAL PUBLICATION ASSOCIATION OF AMERICAN FERTILIZER CONTROL OFFICIALS, 1953-1954. 108 pages, price $1.00. Reports of committees; address of president, secretary; directions for sampling fertilizers; present status of surface wetting agents for fertilizer use; summary of fertilizer questionnaire; list of fertilizer control officials.

STATIC AND DYNAMIC VARIATION IN THE RESPONSE OF AN INSECT TO SUBLETHAL DOSES OF TWO GASES by *C. I. Bliss* and *R. L. Beard*. 24 pages. The rate at which an insecticide-resistant race can be developed by selection may be governed by the relative magnitude of static and dynamic variation in the response of individual insects to the toxicant. Test procedure and tabulated results are listed. Conn. Agr. Exp. Sta. Bulletin #577.

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they're positively deadly to bugs!

Ever see a covey of bugs fly unscathed through a cloud of insecticide like they had radar? Or see them shake off a direct hit and amble away unharmed and unconcerned? That's the time to start specifying GEIGY METHOXYCHLOR, the chemicals that are positively deadly to pests but relatively safe to human beings and animals. GEIGY METHOXYCHLOR products are effective for fly control, storage pests and for fruit, vegetable and forage crops. They are available as the following:

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(90% methoxychlor)

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GEIGY METHOXYCHLOR "50"
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ORIGINATORS OF Geigy DDT INSECTICIDES

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Aberdeen, N. C.; Burlington, Iowa; Elkton, Md.; Fresno, Calif.; Houlton, Me.; Leland, Miss.; McGregor, Tex.; Orlando, Fla.; Yakima and Walla Walla, Wash.

A STUDY OF PHOSPHATE FERTILIATION AND LEGUME ROTATIONS FOR SMALL GRAIN WINTER PASTURES by *H. J. Harper*. 26 pages. Effect of fertilization on minerals in forage; yield and protein data on studies with varied and uniform fertilization. Oklahoma Agri., Exp. Sta. Bulletin #B-414.

KILLING UNDESIRABLE WOODY PLANTS WITH CHEMICALS by *L. S. Hamilton* and *R. R. Morrow*. 4 pages. Application of fungicides to woody plants. Chemicals considered included: 2,4,5-T; ammonium sulfamate; and sodium arsenite. Mimeographed bulletin by New York State College of Agriculture, Ithaca, NY.

PRODUCTION PRACTICES IN GROWING SWEETPOTATOES IN THE COASTAL PLAIN AREA OF SOUTH CAROLINA by Dudley L. Perry. 35 pages. Labor and power requirements, estimated cost and returns, production practices. Bulletin 407. South Carolina Agric. Exp. Sta., Clemson, S. C.

ANDERSON AND TAYLOR . . TWO NEW WHEAT VARIETIES by W. R. Paden and E. B. Eskew. 8 pages. Yield performance, habit of growth resistance to mildew and leaf rust, resistance to lodging. Circular 92. South Carolina Agric. Exp. Sta., Clemson, S. C.

WHY PAPAYA TREES FAIL TO FRUIT by W. B. Storey. 10 pages. Lack of nutrients, poor soil aeration, poor drainage, insufficient water, mite and insect damage, diseases. Circular 339. University of Hawaii

1954 SPRAY RECOMMENDATIONS FOR TREE FRUITS IN EASTERN WASHINGTON. 32 pages. General recommendations, dust applications, spray program, fruit diseases, insects and mites, nutritional sprays; bee poisoning. Bulletin 419, Revised. Extension Service, State College of Washington, Pullman, Wash.

56th REPORT ON FOOD PRODUCTS and the 44th REPORT ON DRUG PRODUCTS, 1951, by H. J. Fisher. 80 pages. The report summarizes examination of foods, drugs, cosmetics and miscellaneous materials submitted by the Food and Drug Commission and the Commissioner of Farms and Markets during the calendar year 1951, as well as like materials analyzed for health departments and others.

COMMERCIAL FERTILIZERS FOR WINTER WHEAT IN RELATION TO THE PROPERTIES OF NEBRASKA SOILS. by R. A. Olson, and H. F. Rhoades. 84 pages. Published by the Nebraska Agric. Exp. Sta., Lincoln, Neb.

GYPSUM FOR IMPROVING DRAINAGE OF WET SOILS. by J. C. Rinehart, G. R. Blake, J. C. F. Tedrow, and F. E. Bear. 16 pp. Agricultural uses for gypsum in the U. S. Use of gypsum for draining wet spots; applying gypsum for improved drainage. Bulletin 772. New Jersey Agric. Exp. Sta., New Brunswick, N. J.

Dalapon Studies Reported

DALAPON* has been found to be herbicidally active on several grass species at relatively low rates (1) (2) (3). Laboratory investigations have established that it is actively absorbed by and transported through living grass foliage. It is also readily absorbed by roots and transported to growing points following soil application.

New growth of grasses is often malformed following the application of dalapon and there is frequently some proliferation of tissue. At suitable rates old foliage gradually becomes chlorotic and dies. Grass seedlings of many species are often stunted for a considerable period following treatment. They may eventually recover from low rates of application.

Established perennial grasses also exhibit malformation of new growth and necrosis of old leaves following the application of dalapon. The chemical appears to induce dormancy of crown and rhizome buds for varying lengths of time depending on the dosage used and on environmental conditions. At suitable rates of application dormant buds fail to recover and a high degree of root kill results. At lower rates of application dormant buds tend to recover.

Results to date have indicated that dalapon is a promising herbicide for several uses, however, further research is necessary before any specific recommendations can be made.

Crops such as apples, pears, and raspberries appear adequately tolerant of dalapon to permit its use in grass control around the base of the plant. Even more sensitive crops such as corn may tolerate basal directed sprays.

Laboratory and field experiments with dalapon have been conducted by several workers during the past two years. The more pertinent indications to date are as follows:

1. Dalapon is absorbed by and transported through living grass tissue. It is also absorbed by roots following soil application.
2. It has been found to have short residual effect in the soil.
3. On several perennial grass species a high degree of root kill is often obtained with rates of 20 to 40 pounds per acre. Retreatment or subsequent tillage will usually be required to prevent reinfestation by seedlings and surviving plants.
4. Treatment of perennial grasses has been most effective where applied to give good wetting of foliage after considerable growth has occurred but before seed stalk development.
5. The sensitivity of annual grasses decreases rapidly with increased age of the plant.
6. Dalapon offers considerable promise for selective uses in several crops including alfalfa, flax, beets, and cotton. Directed basal sprays in cotton appear particularly promising.

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Malathion for Birch Leaf Pest

Studies at the Connecticut Agricultural Experiment Station, indicate that either malathion or lindane sprays give excellent control of the birch leaf miner. Malathion is reported to give 100 per cent control of the miner when sprays are applied in mid-May. Lindane is almost as effective. Sprays to control the first brood should be applied whenever birch leaves are fairly well developed—in most years, this is between May 12 and 17. A second treatment may be made in late June or early July.

Spray dosages which have given best results are 57 per cent malathion emulsion or 25 per cent lindane emulsion at the rate of ½ to 1 pint in 100 gallons of water or, for small areas, ½ to 1 teaspoon per gallon. Wettable powders may also be used at the rate of 1 to 2 pounds per 100 gallons of water or 1 to 2 teaspoons per gallon.

* Dalapon is the common name for 2,2-dichloropropionic acid.

Summary of report by A. J. Watson, Dow Chemical Co., Greenville, Miss., presented to the Southern Weed Control Conference, Memphis, Tennessee, Jan. 10-13, 1954.

LET IT RAIN!

...CPR kills insects Fast

Rainfall as early as four to six hours after application of a CPR-based dust usually doesn't necessitate immediate redusting. CPR-based dusts and sprays provide extra fast kill – and are effective against the wide range of insects shown at right.

No build-up of immunity to CPR dust has ever been found – and this is proving an important consideration in the control of an increasing number of pests.

Formulate your crop dusts and sprays with CPR – the combination of piperonyl cyclonene, pyrethrins and rotenone gives your product the extra power of synergism, with effectiveness on a wider range of insects. Yet CPR leaves no toxic residues – no special processes are needed to remove deposits as the washings ordinarily given fresh vegetables are sufficient. Operators don't have to wear respirators or special clothing.

Insects controlled by insecticides containing 20% CPR

- Asparagus beetle
- Saw flies
- Flea beetles
- Bean leaf beetles
- Cabbage worms
- Celery leaf tier
- Squash vine borer
- Blister beetle
- Ants web worms
- Blueberry maggots
- Blueberry fruit flies
- Imported cut worms
- Fruit worms
- Bean beetles
- Spotted cucumber beetles
- Thrips (except onion and gladioli)
- Pickle worms
- Colorado potato beetle
- Young horn worms
- Melon worms
- Potato aphids
- Harlequin bugs
- Corn earworms on beans

For complete information about the formulation of dusts or sprays based on CPR—or about their use and where to buy them – write us today.

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You can now look to Pennsalt as an even better source for your BHC needs. From the new Calvert City, Kentucky plant, Pennsalt, the pioneer manufacturer of high gamma BHC, can supply you with 46% High Gamma Technical.

High Gamma content enables production of more highly concentrated dust bases, wettable powders or liquid formulations. Penco High Gamma BHC can be melted and impregnated for the production of quality cotton dusts; or easily dissolved in common solvents to produce superior formulations at lower costs.

Penco BHC Technical containing 14% gamma is now also available from Pennsalt in flake form, for those who wish merely to grind and extend it into dust bases or finished cotton dusts.

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CORN ROOTWORM

36-40% GAMMA ISOMER

Among the very few manufacturers of high concentrate BHC, Columbia-Southern is one of the world's leaders. This product is eminently suited for the control of corn rootworm in the cornbelt, and spittlebug on hay and other crops.

CORN ROOTWORM

In the cornbelt region, regardless of weather conditions, rootworm activity causes some corn to lodge badly and reduces yield.

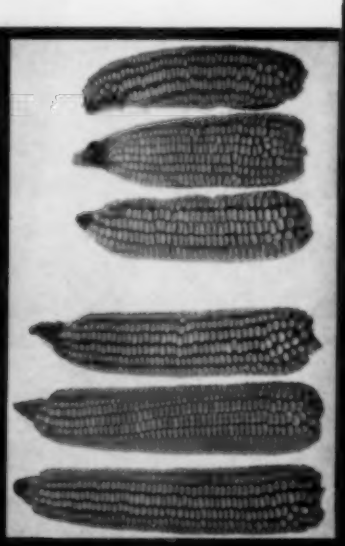
Actual losses in dollars and cents due to this insect pest are tremendous. Tests have shown yield reductions ranging from 10 to 30 percent in infested fields where hand picking of corn is used. Where harvesting machinery is employed, the lodging creates further difficulties and the losses are even greater.

High concentrate BHC, furnished by Columbia-Southern, is a recommended insecticide because it has proved so highly successful.

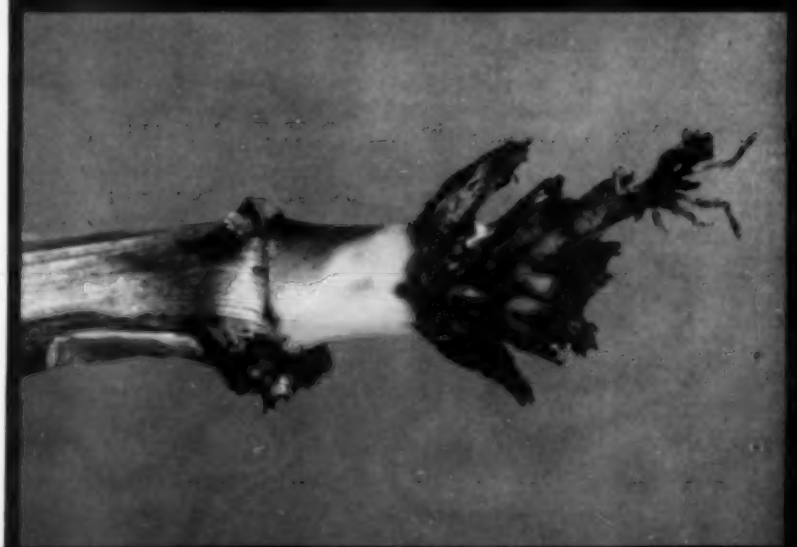
In applying BHC, use a broadcast spray over planting area at the third discing with BHC at the rate of ½ lb. gamma isomer per acre. This treatment prevents rootworm infestation before damage can occur.

INCREASE CORN YIELD
INCREASE PROFITS
with COLUMBIA-SOUTHERN BHC

Damaged plants lodge and "gooseneck."



Ears underdeveloped, reduced yield.



Corn stalk showing severe root pruning by rootworms.

Pictures courtesy Iowa State College

CONCENTRATE effectively controls and SPITTLEBUG

Foreground BHC treated.
Background untreated.

(A) BHC treated clover.
(B) Untreated clover.

Masses of spittle produced by spittlebug nymphs.

Pictures courtesy Pennsylvania Agricultural Extension Service

SPITTLEBUG

Unsatisfactory yields of first-cutting hay from clover and alfalfa fields have often been due to damage from spittlebugs.

Spittlebugs overwinter in the egg stage and hatch as nymphs in early April in Southern areas, and in late April or early May in the Northern areas.

These nymphs, clustered in spittle, stunt the growth of alfalfa and clover hay by sucking away the plant juices.

On the first cutting, the yield is often reduced by as much as 50% and the quality of the hay also suffers.

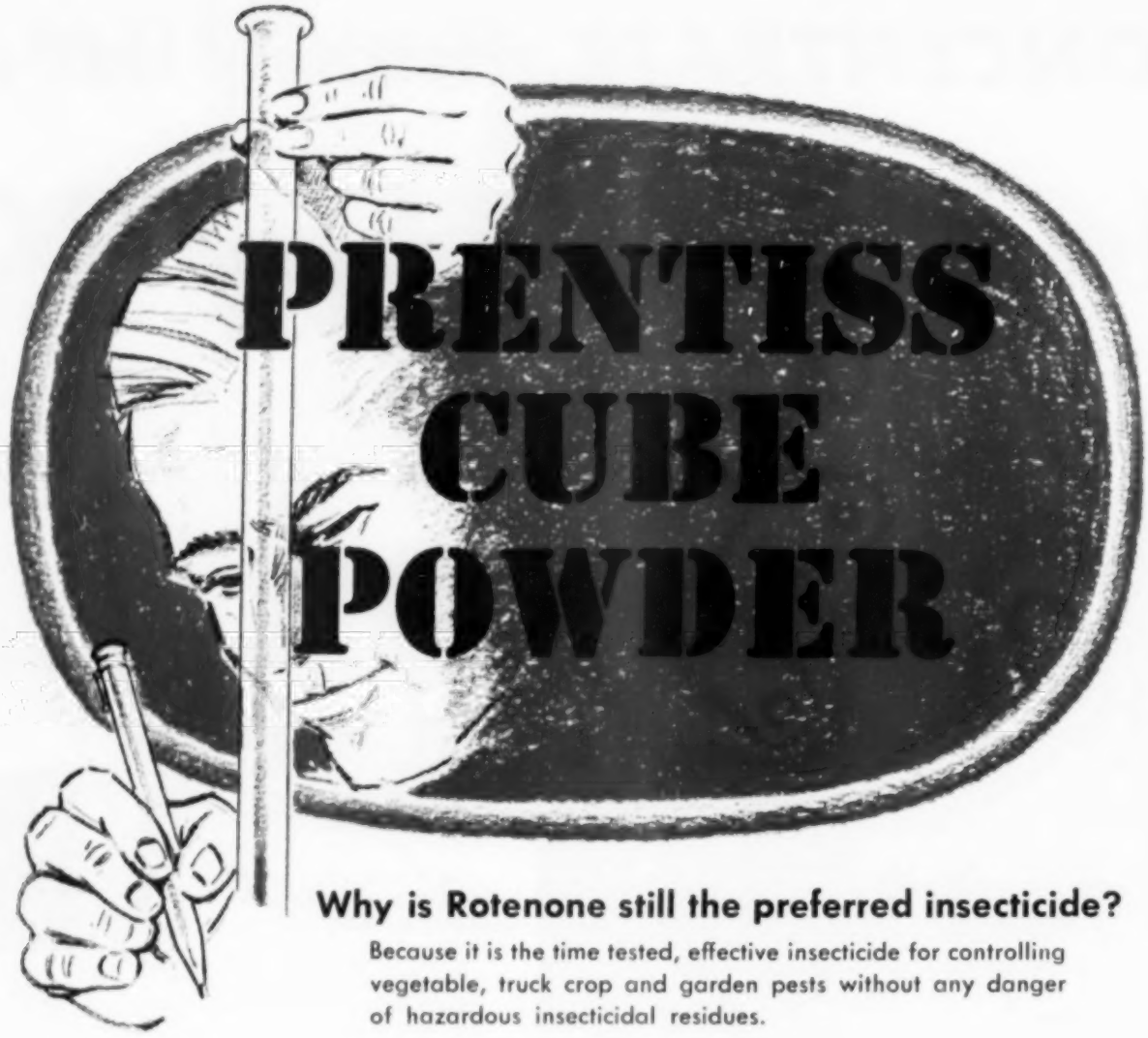
BHC concentrate, produced by Columbia-Southern, is an insecticide that makes it easy to control this damaging pest.

One broadcast treatment of BHC just as the nymphs are beginning to hatch will reduce spittlebug population 90 to 99 percent.

INCREASE CROP YIELDS
INCREASE CROP QUALITY
INCREASE PROFITS
with COLUMBIA-SOUTHERN BHC

Write or wire our BHC Department today for further information and the name of your nearest supplier

COLUMBIA-SOUTHERN CHEMICAL CORPORATION
SUBSIDIARY OF PITTSBURGH PLATE GLASS COMPANY
ONE GATEWAY CENTER · PITTSBURGH 22 · PENNSYLVANIA



Why is Rotenone still the preferred insecticide?

Because it is the time tested, effective insecticide for controlling vegetable, truck crop and garden pests without any danger of hazardous insecticidal residues.

Why is Prentiss Rotenone Powder the preferred brand?

Because **Prentox Cube is the bonus product.** Every 5,000 pounds is batch blended and analyzed for Rotenone content to guarantee the insecticide manufacturers a genuinely standardized Rotenone Powder.

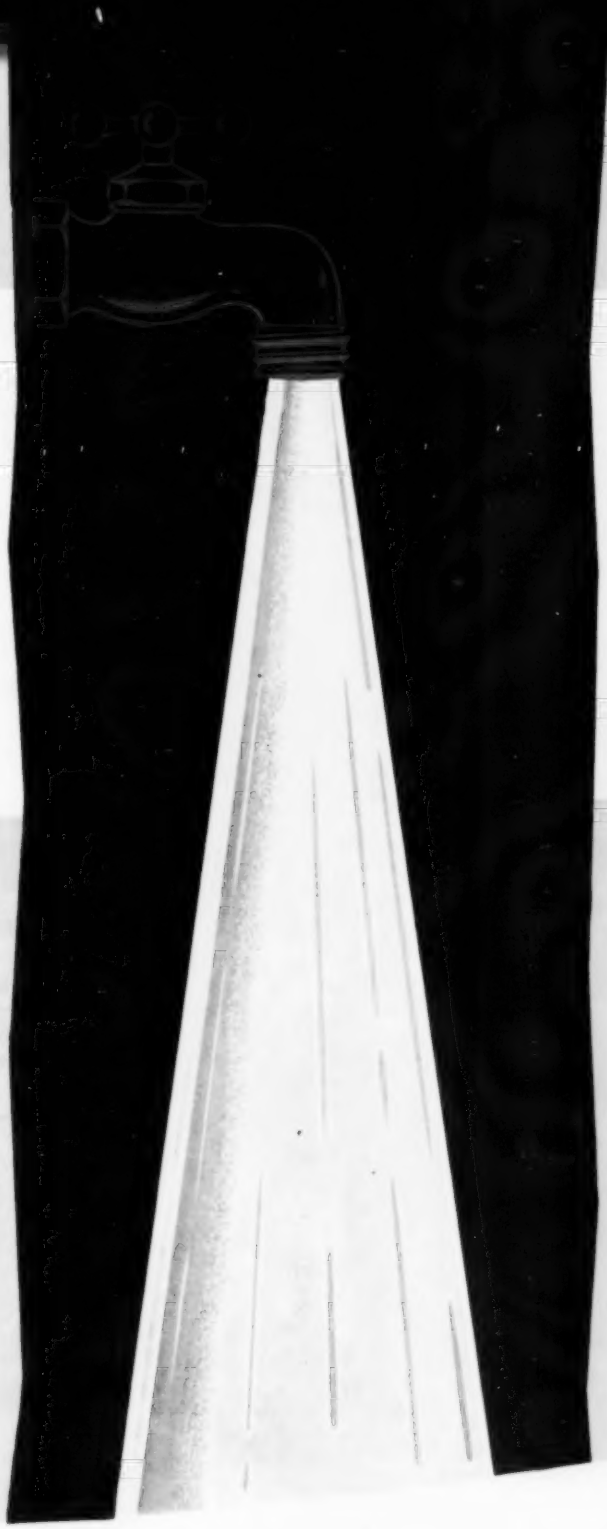
Use Prentox Cube Powder for your quality insecticide formulations and greater profits to you.

OTHER PRENTISS PEST-TESTED PRODUCTS ARE:

Rax Powder (5% Warfarin) for control of rodents
Pyrethrum
Allethrin
Pyronyl Concentrates
Lindane
DDT
Chlordane

PRENTISS DRUG & CHEMICAL CO., Inc.

110 William Street New York 38, N. Y.



For water, water, anywhere . . .

there's a matched ATLOX® emulsifier

With what type of water will your emulsifiable toxicant concentrate be diluted? You may require one emulsifier for soft water, and another for use in hard water areas. If your product is to be used in areas of varying water hardness, you will require still another, a good general-purpose emulsifier.

Atlas has developed a wide line of ATLOX emulsifiers to work with any type of water, any toxicant, any solvent. Our experience in working for many years with leading formulators stands ready to serve you in applying these emulsifiers to your own product.

Bring your emulsifier problems to Atlas. Fill out the table below, and return it to us. We'll be glad to recommend an ATLOX emulsifier or blend that's tailor-made for your specific requirements.

EMULSION DATA CHECK LIST

1. Toxicant used_____
2. Solvent used_____
3. For water hardness_____ ppm.
4. Recommended dilution_____
5. Lbs. toxicant/gal. of concentrate_____
6. Desired emulsion stability_____
7. Shelf life period expected_____
8. Ease of dispersion important?_____
9. Packaging: bulk_____ or small container_____
10. How is concentrate mixed and evaluated in laboratory tests?_____

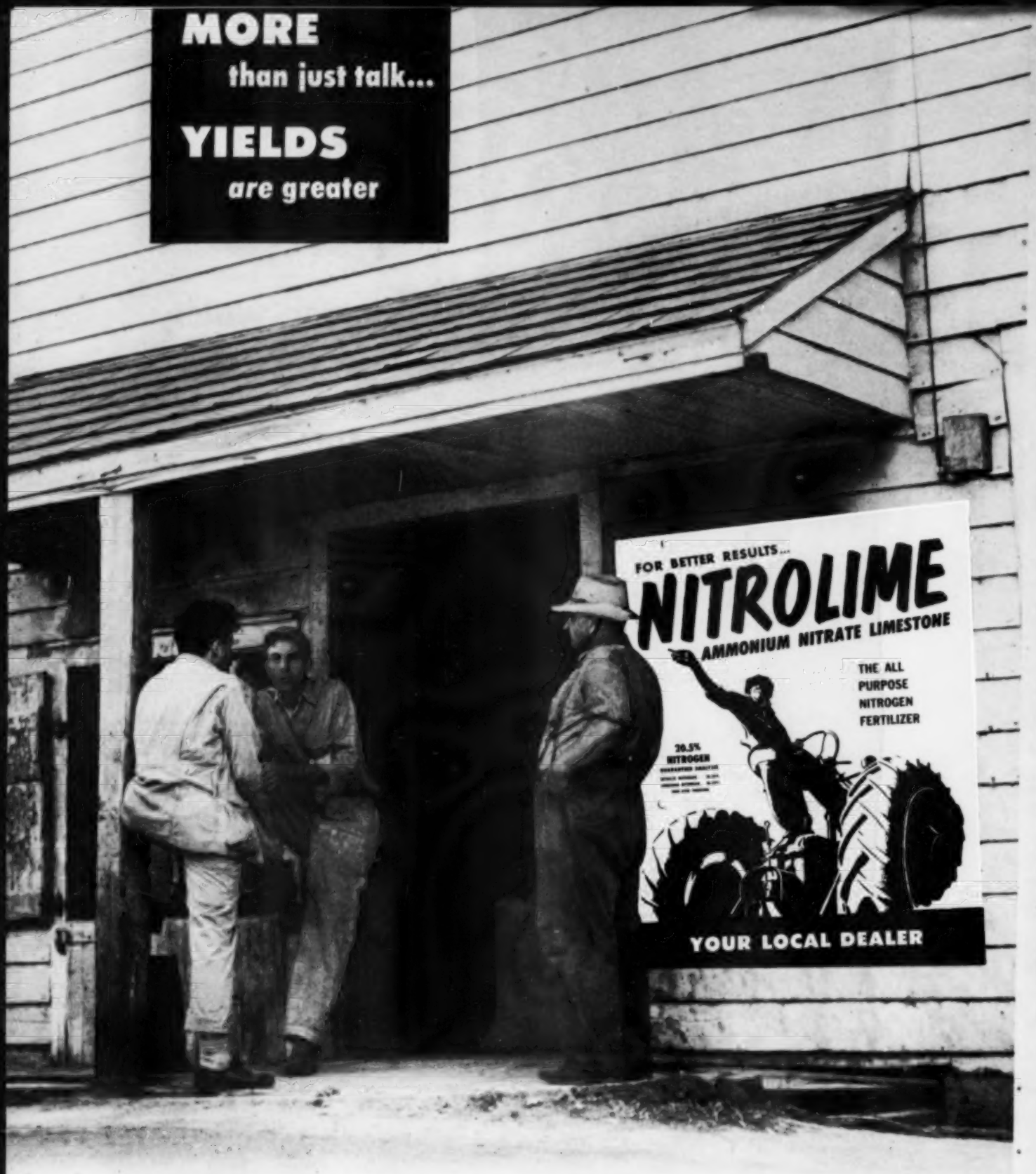
INDUSTRIAL CHEMICALS DEPARTMENT

ATLAS POWDER COMPANY

WILMINGTON 99, DELAWARE

offices in principal cities

ATLAS POWDER COMPANY, CANADA, LTD.
BRANTFORD, CANADA



NITROLIME **is a non-acid forming, granular nitrogen fertilizer formulated for easy crop distribution plus good mechanical condition even after prolonged periods of storage.** ***NITROLIME*** **is readily available for quick delivery from stocks at all important South Atlantic and Gulf ports.**

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Only 2 Emulsifiers needed to Emulsify 22 Toxicants!

TRITON X-150 and TRITON X-160, when used alone or in combination with each other, will economically emulsify toxicant-solvent systems of the various pesticides listed here. These efficient emulsifiers give top field performance *and* they are effective in hard or soft waters.

Formulators will find that TRITON X-150 and TRITON X-160 can easily replace the assortment of emulsifiers usually required to emulsify the many pesticides in use today. The advantage of operating with a minimum emulsifier inventory and the low levels of TRITON X-150 and TRITON X-160 required for good toxicant emulsions offer extra savings to the formulator.

Write or call the nearest Rohm & Haas office for complete technical information.

Toxicants emulsified by TRITON X-150 and TRITON X-160.

Aldrin	Dieldrin	Nitrox 80**
Aramite*	Endrin	Parathion
BHC	Heptachlor	Rhothane
BHC-DDT	Lindane	Toxaphene
Chlordane	Malathion	Toxaphene-DDT
DDT	Methoxychlor	

Butoxy ethoxy propanol Ester of 2,4,5-T
Butyl Esters of 2,4-D and 2,4,5-T
Chloro-IPC
Iso-octyl Esters of 2,4-D and 2,4,5-T
Isopropyl Esters of 2,4-D and 2,4,5-T

CHEMICALS FOR INDUSTRY

ROHM & HAAS COMPANY

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Representatives in principal foreign countries

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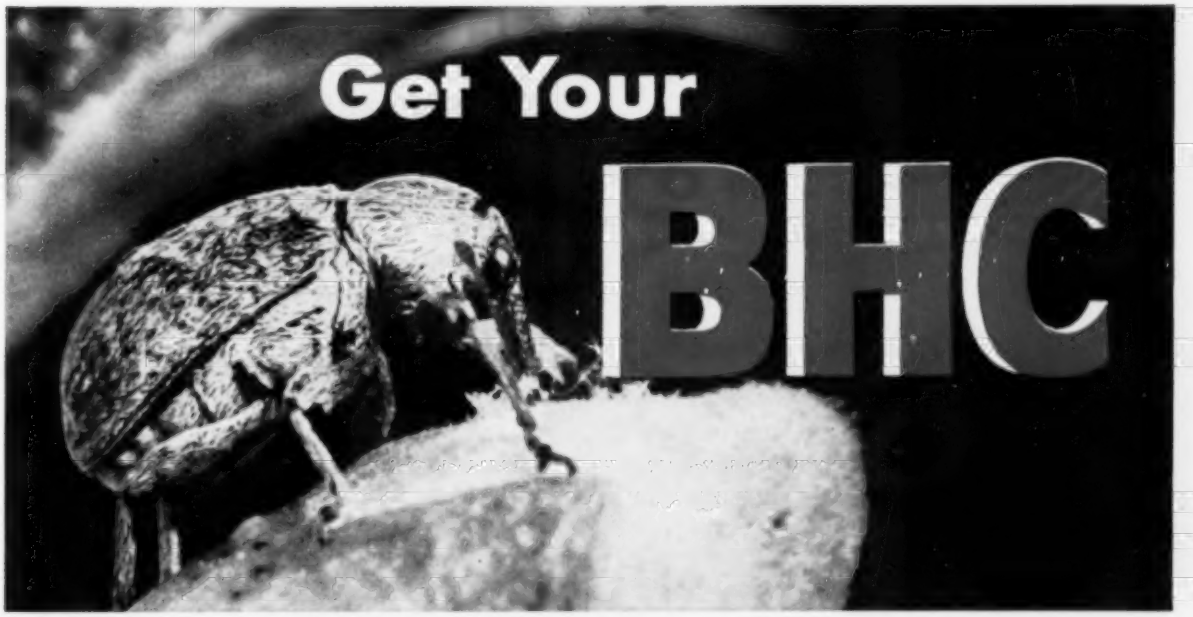
**Chemagro Corporation



from GENERAL CHEMICAL

The No. 1 Cotton Poison from the No. 1 Source

In a leading cotton state last year almost 80% of the cotton dusts were based on Benzene Hexachloride. BHC's high effectiveness against cotton pests such as boll weevil, aphids, thrips, fleahoppers and plant bugs, will continue to keep it in the forefront as a cotton insecticide.

When you buy your technical BHC or other base materials from General Chemical you get the highest quality material . . . as you want it and when you want it.

For fast service, General Chemical carries stocks of technical BHC (15% and 36% gamma content) at key points across the country; in the east at Marcus Hook, Pa., in the south at New Orleans, La., and in the west at El Segundo, Calif.

Remember—when you do business with General Chemical —the same phone call that orders your BHC can also bring you any of the other base materials listed here!

Allied Chemical

Agricultural Chemical Department

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.

Serving Agriculture from Coast-to-Coast

FORMULATORS AND DUST MIXERS CHECK THIS LIST!

BHC
Technical (15% & 36% Gamma)

TDE (DDD)
Technical, Flake
Dust Base (50% TDE)

DDT
Technical, Flake or Granular
Dust Base, 50% & 75%

LINDANE
Technical
Dust Base, 25%, 75%, 95%
Emulsifiable Concentrate, 20%
Oil Concentrate, 20%

ORGANIC MITICIDES
Genite® 883 (p-chlorophenyl p-chlorobenzene sulfonate) Technical
Genite 923 (2,4-dichlorophenyl ester benzene sulfonic acid)
"Aramite" Technical

LEAD ARSENATE
Standard
Astringent
Basic

CALCIUM ARSENATE
Standard
Low Lime

PARATHION
Dust Base
Emulsifiable 2 & 4 lbs. per gallon

FERBAM
Dust Base (76% ferric dimethyl-dithiocarbamate)

ZIRAM
Dust Base (76% zinc dimethyl-dithiocarbamate)

WEED KILLERS
2,4-D
Acid, and Technical Esters
2,4,5-T
Acid, and Technical Esters
TCA SODIUM SALT
90% Dry Powder
50% Liquid Concentrate

POTASSIUM CYANATE
Technical
Weed Killer

STA-FRESH†
Sodium Bisulfite
silage grade

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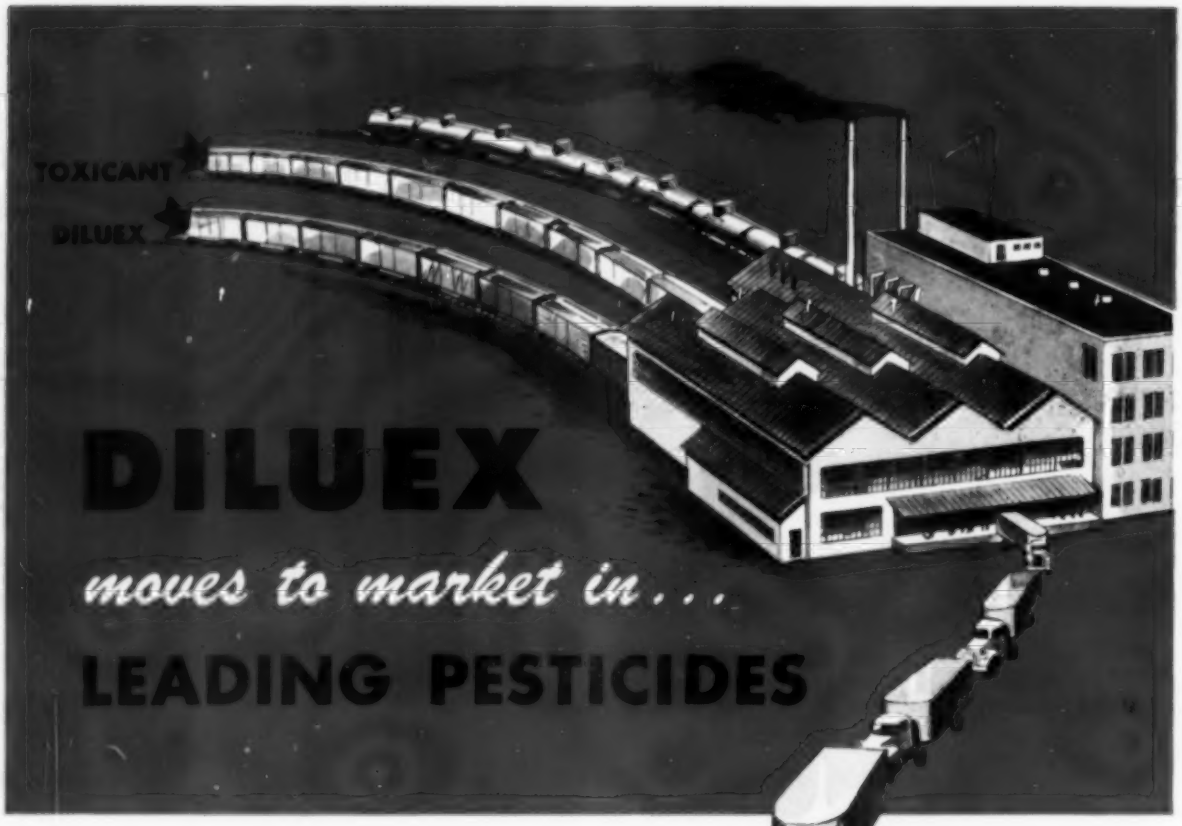
A Better America Through Chemical Progress · CHEMICAL PROGRESS WEEK · May 17 to 22, 1954



On the basis of technical study and practical experience, Floridin products, extracted and specially processed at Quincy and Jamieson, Florida, are coming into more and more general use in the agricultural chemical industry.

Are you impregnating toxaphene—chlordane—aldrin—parathion—any liquid toxicant?

Are you milling DDT, BHC, or other organics?

Formulating blended dusts?

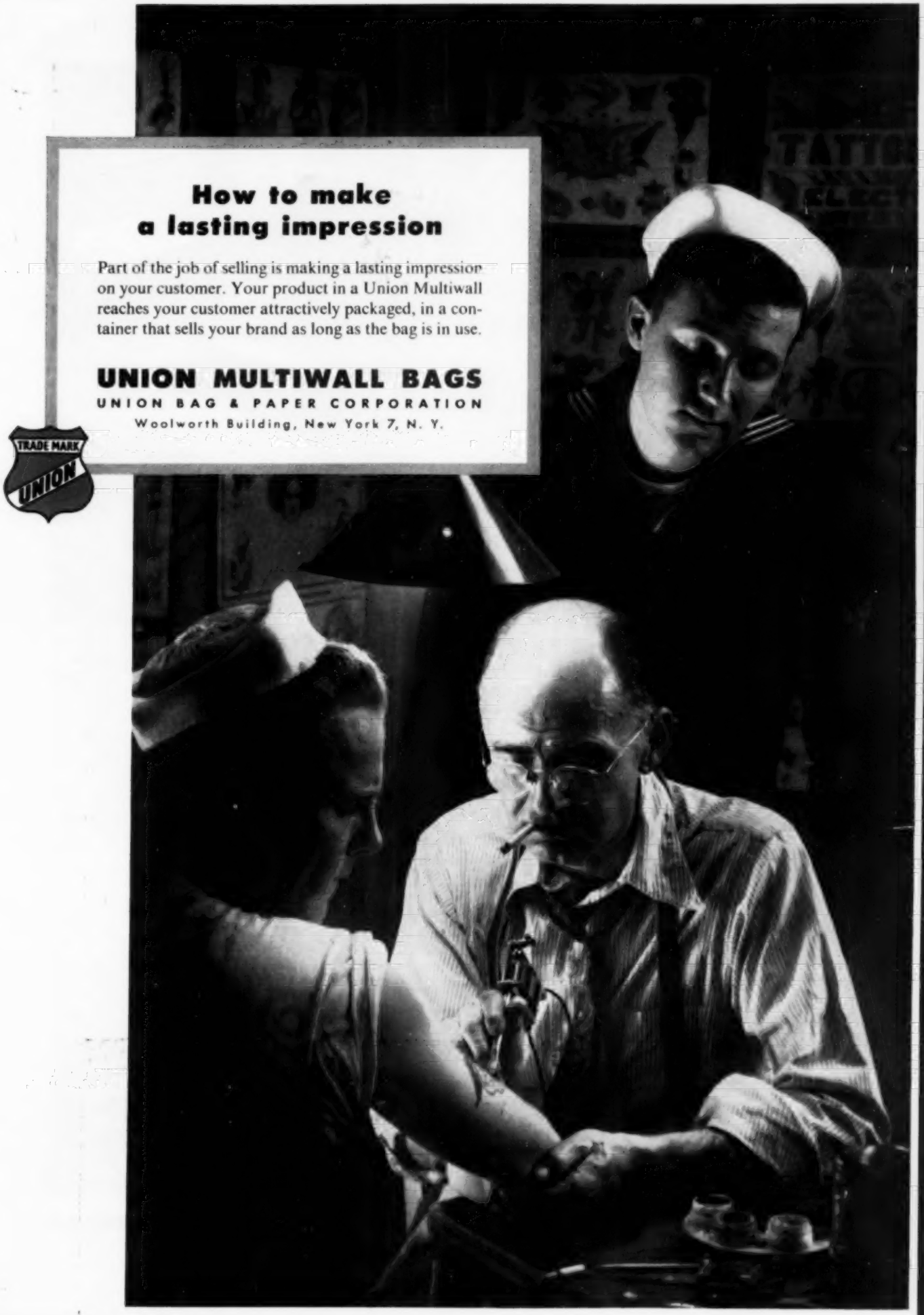
For any of these processes, it will be worth your while to learn about DILUEX and DILUEX-A.

As grinding aids, adsorbent concentrate bases, and dust conditioners for the most exacting uses of the industry, Floridin products have won a leading place. The demand for DILUEX and DILUEX-A, increasing steadily for many years, has recently grown to multiplied tonnage. Production facilities have been enlarged accordingly, and shipments are being made without delay, by train and truck from two Floridin plants at Quincy and Jamieson, Florida. Correspondence is invited.

FLORIDIN COMPANY

Adsorbents . . . . Desiccants . . . . Diluents

Dept. M, 120 Liberty St., Warren, Pa.



How to make a lasting impression

Part of the job of selling is making a lasting impression on your customer. Your product in a Union Multiwall reaches your customer attractively packaged, in a container that sells your brand as long as the bag is in use.

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UNION BAG & PAPER CORPORATION

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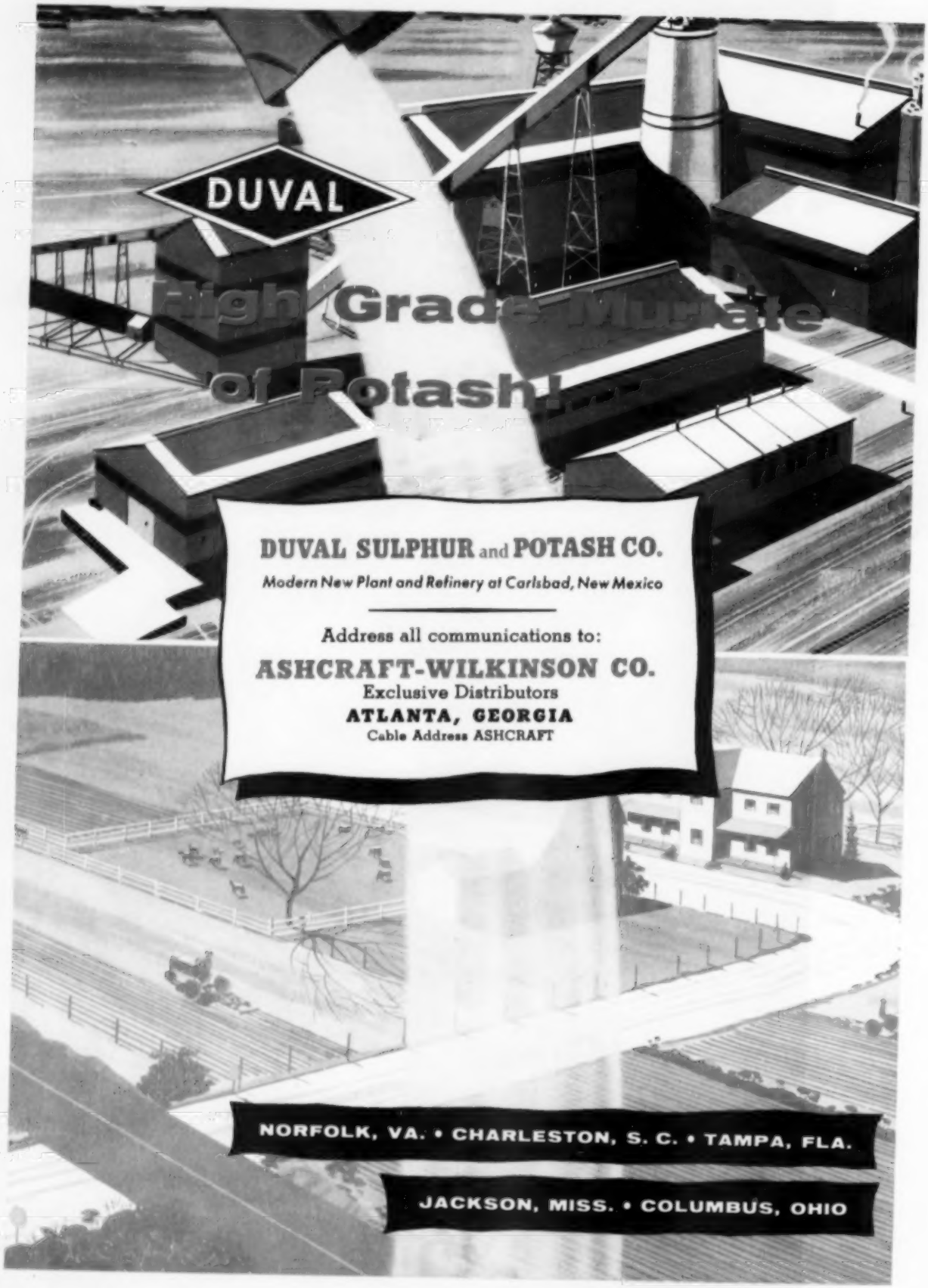
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High Grade Muriate
of Potash!
DUVAL SULPHUR and POTASH CO.
Modern New Plant and Refinery at Carlsbad, New Mexico
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DORR Developments in the field of concentrated fertilizers:

THE DORRCO STRONG PHOSPHORIC ACID PROCESS . . . the first process successfully developed for producing a strong acid. In operation, it has conclusively proven that it will economically and reliably produce 32 to 33% P_2O_5 phosphoric acid with a single stage of filtration.

THE DORRCO FINES RECIRCULATION SYSTEM . . . produces a 100% granular product of exceptional uniformity. This is the only system which can be used interchangeably to produce triple superphosphate, ammonium phosphates, ammonium sulfate or complete granular concentrated products.

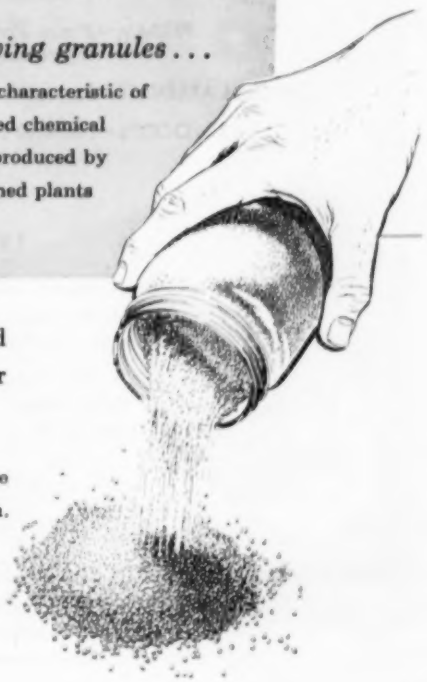
A CONTINUOUS METHOD of producing granular triple superphosphate with evaporation to only 38 to 39% P_2O_5, with no need for subsequent aging or curing of the product.

THE DORRCO SYSTEM of continuous vacuum evaporation which eliminates serious scaling, reduces P_2O_5 losses to a negligible point and involves no fume problem.

THE MANUFACTURE of ammonium sulfate from calcium sulfate obtained as a by-product of phosphoric acid production.

THE DORRCO FLUOSOLIDS SYSTEM... a new method for producing high strength SO_2 gas from pyrite and for the calcination of phosphate rock.

free-flowing granules . . .
important characteristic of concentrated chemical fertilizers produced by Dorr-designed plants



Dorr operates a complete consulting engineering service backed by 35 years of experience in the field of concentrated fertilizer production by the wet process.

Bulletin No. 8000 gives additional information about Dorr's experience and facilities in this field. Write to THE DORR COMPANY, Stamford, Conn.

BEST BUY FOR '54

THE COMPLETE PENCO® LINE

For Formulators and Dust Mixers

DDT—*Pentech®, H*—the exclusive friable granular form of technical DDT for maximum production.

DDT Technical—In lump or flake form, to meet your processing needs.

50% DDT Dust Base—A uniform, free-flowing dust base, ideal for extending to finished dusts when limited equipment or need for emergency production call for a prepared dust base.

BHC—*Penco High Gamma BHC Technical*—46% gamma content for production of more highly concentrated dust bases, wettable powders or liquid formulations.

Penco BHC Technical—The natural isomer in convenient flake form, for processing into dust bases or finished cotton dusts.

BHC Dust Bases—For greater production of finished dusts in the rush season, choose among: *Penco BHC D-12; Penco BHC D-18;* and *Penco BHC-DDT 9:15,* a combined concentrate for direct extending to cotton dust in the 3:5 ratio.

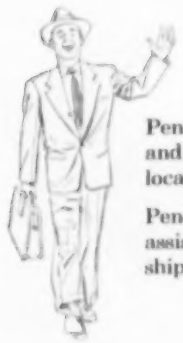
LINDANE—*Penco Hi-Gam®*—Technical lindane crystals for processing into dusts, wettable powders or liquids.

Penco Hi-Gam® W-25—A wettable powder and dust base containing 25% lindane.

FERBAM—*Penco Ferbam*—A wettable powder and dust base for spray use and for extending to field strength dust formulations.

CALCIUM ARSENATE—In standard and low-lime grades; contains 70% tri-calcium arsenate.

KRYOCIDE®—Natural Greenland cryolite for formulating specialty dusts or wettable powders.



LET THESE PENCO SERVICES HELP *YOU*

Pennsalt provides a wide variety of technical and concentrate products from strategically-located plants and warehouses.

Penco Technical Sales Service available to assist in determining the most economical shipping and quantity buying plan for you; and in formulating and using the wide variety of Penco pesticide concentrates.

Before the "big-rush" season, why not ask your local Pennsalt representative to call and discuss the many services and products that make Penco *your* best buy for '54.

AGRICULTURAL CHEMICALS

Pennsylvania Salt Manufacturing Company of Washington

Tacoma 1, Washington • Philadelphia 7, Pennsylvania

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Pennsalt Chemicals

We like TOUGH package problems

FOR EXAMPLE, one of our customers who realized the advertising possibilities of his shipping sacks, suggested a design in colors so brilliant as to seem, offhand, impossible of reproduction on tough kraft stock.

But we experimented with various inks and methods of application and came through with just what the customer wanted.

Could we ship on short notice? We could. *And did.*

Are *your* shipping sacks providing full value from the standpoint of impressive advertising? Call in the Raymond man for constructive suggestions. No obligation.

THE RAYMOND BAG COMPANY
Middletown, Ohio. Phone 2-5461

Raymond
MULTIWALL PAPER SHIPPING SACKS

INDUSTRY *News*

Braun to Potash Institute

Grant Braun has recently been employed as field agronomist by

GRANT BRAUN

American Potash Institute for the Pacific Northwest area. He replaces George Wickstrom, who moves to Missouri and will now represent the same organization in this area of the midwest. Mr. Braun comes to the Institute from the northwest agricultural staff of Libby, McNeill and Libby. His major training includes both plant pathology and soils.

•

Wickstrom Transferred

The American Potash Institute has transferred George A. Wickstrom to the Midwest after seven years as field agronomist in the northwest. Replacing Mr. Wickstrom is Grant H. Braun, who will have headquarters in Portland, Ore.

Mr. Wickstrom, who will work from the API office in Lafayette, Ind., has served as chairman of the soil improvement committee of the Pacific Northwest Plant Food Association.

•

New Stauffer Plant in Mexico

Stauffer Chemical Co. announced recently the addition of a second insecticide dust manufacturing plant by its Mexican subsidiary, Stauffer de Mexico, S. A. The new plant is located at Rio Bravo, Tamaulipas, in the heart of the Matamoros-Reynosa cotton producing area.

Stauffer de Mexico, S. A. has been operating an insecticide plant at Nogales, Sonora for more than a year. Sales of materials for Eastern Mexico from the Rio Bravo plant will be under the supervision of Roy S. David, territorial sales manager.

•

Pesticide Carryover Down

One bright spot for the 1954 pesticide outlook was given last month when the USDA reported carryover of pesticides from the 1953 season is down considerably from the inventory figure of a year ago. One exception is benzene hexachloride, which is being carried over in quantities 35 per cent higher than 1953.

•

M. H. Whitten Joins Geigy

Geigy Agricultural Chemicals announced last month the appointment of M. H. Whitten as state sales manager of Maine. Mr. Whitten was assistant sales manager of the Farm Supply Department of the Maine Potato Growers Cooperative.

Bahlburg to Wyandotte Post

John H. Bahlburg has been named manager—new products, organic

JOHN H. BAHLBURG

chemicals department of Wyandotte Chemicals Corp., Michigan Alkali Division. In announcing the appointment, Bert Cremers, vice president of the division, indicated that the primary purpose in establishing the new products, organic chemicals department is to simplify the transfer of new products from the research and development division to sales.

•

Miller Bill Green Light

The second version of the Miller Bill, which has strong backing in the pesticide industry, was given the green light for early passage by Congress late last month when the House Interstate Commerce committee unanimously approved it with only minor changes in language and sent it to the House for approval.

Snipes Joins Chemagro

Dr. B. Thomas Snipes has just been named director of sales for Chemagro Corporation, New York,

DR. B. T. SNIPES

it was announced by George W. Hill, Jr., president of Chemagro. Dr. Snipes was formerly with U. S. Industrial Chemicals Co., division National Distillers Prods. Corp., New York, as technical sales representative in the midwest and southwest. His headquarters will be at the New York office of Chemagro which has recently been moved from the Empire State building to 101 Park Ave.

•

Dr. Smith Joins Davison

Dr. Jean G. Smith has joined the research and development division of Davison Chemical Corp. She is a graduate of Goucher College and Johns Hopkins University.

•

S. C. Fertilizer Bill Signed

The 1954 fertilizer bill, providing several changes in existing legislation, has been signed by the governor of South Carolina. Copies will be available to all registered fertilizer mixers and other interested parties after May 1, according to Bruce D. Cloaninger, head of the department of fertilizer inspection and analysis.

•

Stewart Moves Up

Frank B. Stewart, who has been with the company for several years, last month was named to the post of assistant general manager by Miller Products Co.

Mr. Stewart joined the Oregon agricultural chemicals firm after serving five years in the Army during World War II.

•

Fuchs to New Diamond Ofc

Diamond Alkali Co., Cleveland, recently opened a new office in Atlanta for the agricultural chemicals department of the Chlorinated Products Division. Albert F. Fuchs, assistant sales manager, has been named to head the new office. Prior to joining Diamond last year, Mr. Fuchs was manager of Naco Fertilizer Co., Charleston, S. C.

•

New Hercules Chem. Lab

Representatives of the trade press toured the new agricultural chemical laboratory just completed and put into operation by Hercules Powder Co., Wilmington, on April 8. The tour of the new laboratory was preceded by luncheon at the Wilmington Country Club. Paul Mayfield, general manager of Hercules' Naval Stores Department, welcomed the guests with a brief address.

•

J. N. Hall Represents Powell

Robert Zipse, sales manager of the John Powell & Co. division of Mathieson Chemical Corp. has an-

J. N. HALL

nounced the appointment of Pioneer Chemical Associates, Inc., Denver, as sales agents in the Rocky Mountain States. Pioneer, headed by J. Newton Hall, who organized the company about two years ago, will represent Powell in Colorado, Wyoming and New Mexico, and in parts of other states in the surrounding area.

Potts Wins Awards

Samuel F. Potts, of New Haven, Conn., well known as the developer of several types of mist blowers, re-

SAMUEL F. POTTS

cently was awarded a 1953 Nash National Conservation Certificate of Merit. Potts, who has served in several state experiment stations and has done considerable research and experimentation in spraying insecticide mists in finely atomized forms, won the award "in recognition of exceptional services to the cause of conservation." Mr. Potts has also won the USDA merit award for developing the concentrated spray method of ground and aerial spray application. He has conducted research on insect toxicology, physiology, ecology and development of new insecticide and fungicide mixtures.

Mr. Potts at present is at work on a book describing equipment for applying concentrated sprays.

•

Pacific Branch E.S.A. To Meet

The centennial of professional entomology in the United States will be observed by members of the Pacific Branch of the Entomological Society of America at its meeting June 22-24 in Bend, Ore.

One hundred years of insect control by chemicals, developments in taxonomy during the past 100 years, some historical aspects of Pacific Coast Entomology and a panel discussion on entomology in the "roaring twenties" will be included on the program.

Pesticides To Be Featured At Western Cotton Meeting

WESTERN cotton growers will get up-to-date information on best methods of producing cotton in the western section of the Cotton Belt at the third annual Western Cotton Production Conference April 13-14 at Phoenix, Ariz.

The program was announced late last month by E. S. McSweeny, director of the Arizona Cotton Growers Association. The conference will be held in Hotel Westward Ho.

Defoliation, insect control, weed control, and disease control will be on the program. Farmers, representatives of the pesticide industry, vocational agricultural workers, land-grant college representatives, agricultural aerial applicators, USDA representatives, and cotton industry leaders will attend.

The meeting is sponsored jointly by the Arizona Cotton Growers Association, Five States Cotton Growers Association and the National Cotton Council. Cecil H. Collerette, president, Southwest Five States Cotton Growers Association, is conference chairman. Full program is as follows:

Tuesday morning, April 13—Registration, opening remarks by Mr. Collerette; address of welcome, J. Clyde Wilson, president, A.C.G.A.; presiding over morning sessions, George W. Spence, president, El Paso Cotton Growers Association. "The Cotton Disease Situation in the West," P. J. Leyendecker, Project Leader, New Mexico Agricultural Extension Service.

Symposium, Recognizing and Controlling Major Cotton Diseases in the West: J. T. Presley, pathologist, Plant Industry Station, Section of Cotton and other Fiber Crops and Diseases, Beltsville, Md., will be moderator. "Seedling Diseases," I. J. Shields, extension pathologist, Arizona Agricultural Extension Service. "Verticillium Wilt," P. J. Leyendecker, Project Leader, New Mexico Agricultural Extension Service. "Root Knot," H. W. Reynolds, nematologist, U. S. Cotton Field Station "Root Rot and Bacterial Blight," R. B. Streets, pathologist, University of Arizona.

"Breeding for Disease Resistance," George J. Harrison, California Planting Cotton Seed Distributors. "Chemicals for Cotton Disease Control," G. A. Brandes, Rohm and Haas.

Tuesday afternoon—J. Russell Kennedy, general manager, Calcot, Ltd., presiding. "Soil Fertility Problems in the Western Cotton Producing States," Bert Krantz, soil scientist, U. S. Field Station. "The Future of Chemicals for Weed Control in Cotton," W. B. Ennis, agronomist, Section of Weed Investigations, State College, Miss. "Producer Problems in Controlling Weeds," W. B. Camp, Jr., Carolina Farms Gin.

Symposium, Needs and Accomplishments in Chemical Weed Control: W. A. Harvey, weed specialist, California Agricultural Extension Service, will be the moderator, also representing California in the discussions. Representing Arizona will be Fred Arle, USDA agronomist; New Mexico, J. Wayne Whitworth, agronomist, New Mexico Agricultural Experiment Station; and Texas, Paul J. Lyerly, Superintendent, Texas Experiment Station # 17.

"Agricultural Engineering Phases of Weed Control," Herbert P. Miller, agricultural engineer, USDA, U. S. Cotton Field Station.

Wednesday morning, April 14—Mitchell Landers, New Mexico Farm Bureau, presiding. "Role of Beneficial Insects in Cotton Insect Control," Robert van den Bosch, California Agri. Exp. Station.

Panel discussion, "Factors Affecting Cotton Bollworm and Its Control." Representing Texas will be J. C. Gaines, head, entomology department, Texas A & M College; representing New Mexico, E. J. O'Neal, entomologist, Agricultural Products Company; Arizona, W. A. Stevenson, entomologist, Agricultural Research Service, Department of Agriculture; California, G. L. Smith, associate entomologist, California Agricultural Experiment Station.

"Highlights of Research in the West, 1953," H. T. Reynolds, assistant entomologist, California Agricultural Experiment Station. "Relation of Agricultural Chemicals to Public Health," W. J. Hayes, Chief, Toxicology Section, U. S. Public Health Service.

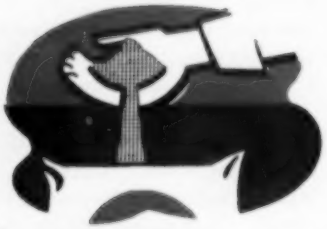
Panel discussion, "Major Insect Problems and Recommendations for Control." Representing California will be J. E. Swift, extension entomologist, California Extension Service, who will moderate the panel. Representing Arizona will be J. N. Roney, entomologist, Arizona Extension Service; New Mexico, R. C. Dobson, extension entomologist, New Mexico Extension Service; and Texas, Neal Randolph, extension entomologist, Texas Agri. Ext. Service.

Wednesday afternoon—Claude L. Welch, Director, Production and Marketing Division, National Cotton Council of America. "Types and Qualities of Cotton Desired by Mills," Graves Jones, Vice President, Jones, Gardner and Beal, Inc. "Defoliation and Mechanical Harvesting as it Affects Ginning," W. H. Fortenberry, U. S. Ginning Laboratory.

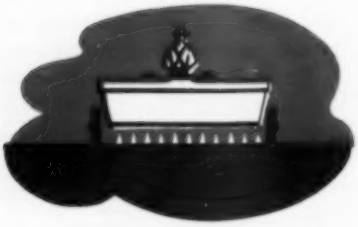
"Application of Agricultural Chemicals with Air and Ground Equipment," Norman Akesson, agricultural engineer, University of California. "Advancements in Bottom Defoliation," Lamar C. Brown, physiologist, U. S. Cotton Field Station.

Panel discussion, Practical Aspects of Cotton Defoliation. Moderator will be W. H. Tharp, principal physiologist, Section of Cotton and Other Fiber Crops and Diseases, USDA, Beltsville, Md. Other members of the panel will include Marvin Hoover, cotton specialist, California Agricultural Extension Service; Angus Hyer, assistant physiologist, U. S. Cotton Field Station; Gordon Hoff, extension agronomist, New Mexico Agricultural Extension Service; V. T. Walhood, physiologist, USDA California Agricultural Experiment Station and Vernon L. Hall, agriculturist, Chipman Chemical Company.

DAVISON GRANULATED Superphosphate 3 WAY CONTROL



STORAGE CONTROL—No caking or lumping while in storage.



APPLICATION CONTROL—No dusting or bridging; drills free and even.

FOOD CONTROL—Supplies plant food at a uniform rate.

Now it is possible for you to store superphosphate without fear of its caking . . . that is, if it is DAVCO GRANULATED SUPERPHOSPHATE. DAVCO Granulated Superphosphate will not become hard or caked . . . it is easier to apply in the field because there is no dusting or bridging over in the drill.

DAVCO Granulated Superphosphate gives complete coverage in the field . . . drilling freely and evenly . . . supplying each plant with a uniform quantity of nutrient phosphorus.

Get DAVCO Granulated Superphosphate . . . the superphosphate that gives you the added sales points through its 3-way control.

Progress Through Chemistry

THE DAVISON CHEMICAL CORPORATION

BALTIMORE 3, MARYLAND

PRODUCERS OF: CATALYSTS, INORGANIC ACIDS, SUPERPHOSPHATES, PHOSPHATE ROCK, SILICA GELS, SILICOFLUORIDES AND FERTILIZERS

Ex-Armour pres. Dies

Charles H. MacDowell, 85, director of Armour & Co., and retired president of Armour Fertilizer Co., Chicago, died March 4th. He had lived in Winter Park, Fla., since his retirement in 1941.

•

Miss. Increases NH_3 Production

Mississippi Chemical Corp. recently put into operation 60 additional tons per day of ammonia capacity. The company plans further expansion, which will bring capacity up to about 290 tons per day. Construction was also started recently on a new ammonium nitrate prilling unit, which will increase prilling capacity to about 500 tons of ammonium nitrate per day.

•

Th-Hayward UDET Distributor

Thompson-Hayward Chemical Co. have been named mid-western distributors in the agricultural field for UDET F surfactants. Local warehouse stocks of UDET F, an alkyl aryl sodium sulfonate, are being maintained by Thompson-Hayward with service from their headquarters in Kansas City, Mo., and their 16 branch offices.

New Union Bag

Union Bag and Paper Corp., offer a bag with a new bottom construction to insecticide manufacturers. It is reported to meet all ICC requirements for shipment of insecticides. The new package is said to be easier to open and "square out," and will stand up during conveyor belt packing. Bags are available in a range of sizes from three to seven pounds.

'54 AEPCO Book Ready

The annual publication of the Association of Economic Poisons Control Officials for 1954 is now ready for distribution. The 200-page text includes association business reports, definitions of terms, convention papers and a resume of state pesticide laws. Included also is a review of sampling procedure and a listing of officials responsible for enforcement of the various statutes. Data covering about 150 pesticide chemicals, including facts on toxicity, are also given.

Copies are available at $3.00 from the Association, Box HH, University P.O., College Park, Md.

•

Bemis Appoints D. A. Clarke

Bemis Bros. Bag Co., St. Louis, announced recently the appointment of D. A. Clarke as assistant manager of the company's Indianapolis plant and sales division. He will take up his new duties about May 1.

•

Webb Retires from CCC

Retirement of A. Magnum Webb from his post as vice president and sales manager of Chemical Construction Corp. was announced recently. His retirement follows the longest period of employment in the firm's history. Mr. Webb began his career with Chemical 40 years ago, when the company was formed, as its first draftsman. He is remaining with the company as a consultant on sales and customer relations.

•

Wheaton Heads Eston Div.

George S. Wheaton, assistant vice-president of American Potash & Chemical Corp., Los Angeles, has ben named to head the company's Eston Chemicals Division. A graduate of Stanford University, Wheaton started his business career in the agricultural chemical field in the San Francisco office of Hercules Powder Co. He later joined the Eston Chemicals business which became a division of American Potash & Chemical Corp. in July, 1952. Peter Colefax is president of American Potash & Chemical Corp.

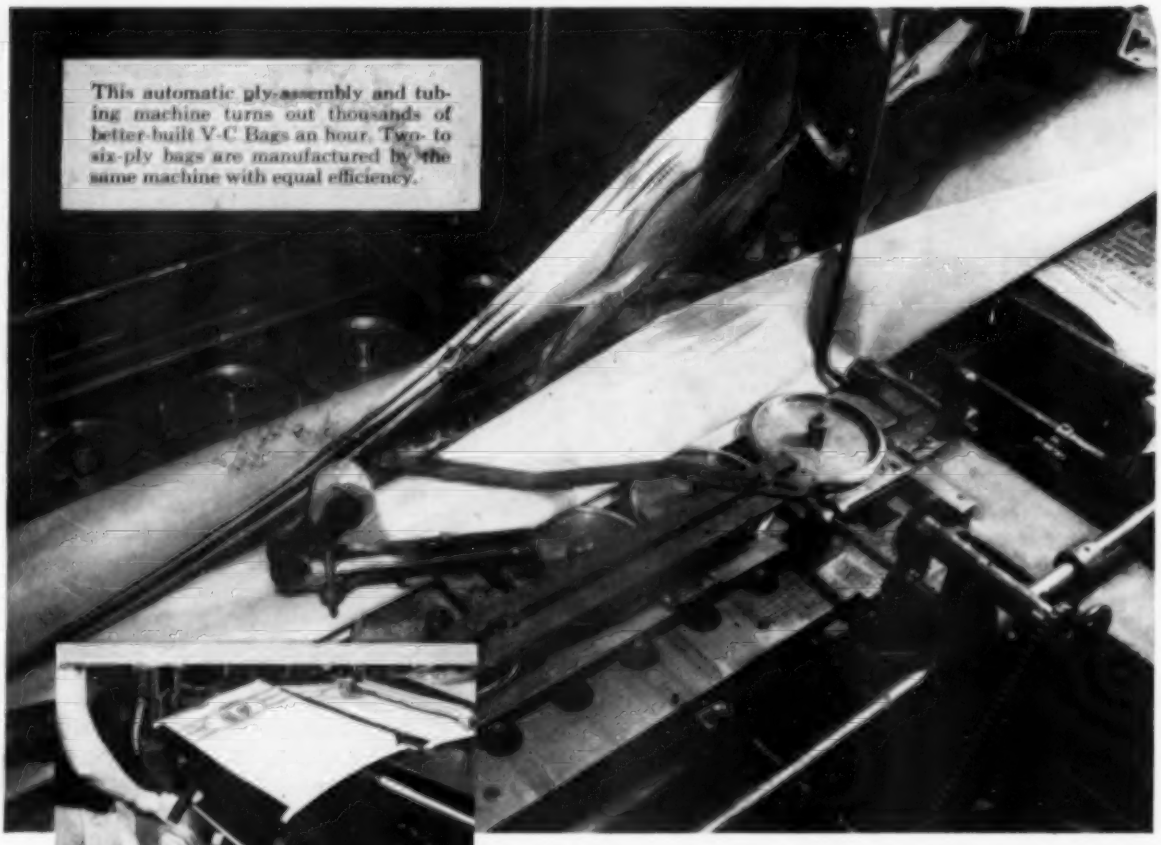
Mathieson Names Baerman, Collazo

Gerard D. Baerman has been named northeast regional sales manager of the Powell Division, Mathieson Chemical Corp., New York, and A. E. Collazo has joined the export department of the division in an executive capacity.

Mr. Baerman was formerly northeast sales manager for Geigy Chemical Corp. and prior to that was in sales work with Shell Chemical Corp. Collazo was formerly purchasing agent and export manager, Agricultural Division, Geigy Chem. Corp.

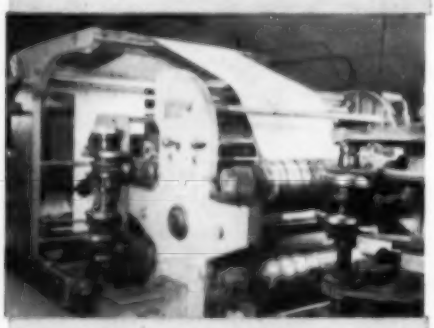
G. D. BAERMAN

A. E. COLLAZO



This automatic ply-assembly and tubing machine turns out thousands of better-built V-C Bags an hour. Two- to six-ply bags are manufactured by the same machine with equal efficiency.

After ply-assembly, tubing and cutting, comes top and bottom sewing. Operator above is inspecting finished sewn-bags as they come from sewing machine.



One of V-C's modern printing presses. Capable of printing from one to four colors, V-C presses help put "sell" in your bags and faithfully reproduce your trade design.

V-C's Modern Equipment Means Better Bags for You

The most modern methods, materials and machines are used in manufacturing V-C Multiwall Bags. This means you get the advantages of the latest developments in bag-making—some of which have been pioneered by V-C. Write for full information about V-C Bags, or discuss your requirements with a V-C representative. It will pay you to get V-C's free technical assistance.

VC® BAGS

MADE AS CAREFULLY AS YOUR BEST TAILORED SUIT

Virginia-Carolina Chemical Corporation

BAG DIVISION: 9th and Perry Streets, Richmond 5, Virginia

DISTRICT SALES OFFICES: Atlanta, Ga. • Wilmington, N. C. • New York, N. Y. • E. St. Louis, Ill. • Cincinnati, Ohio

Food Additives Bill

A bill governing chemical additives in foods, similar in construction to the Miller bill controlling pesticides, has been introduced in to the House by Rep. Joseph O'Hara, of Wisconsin. The bill, H.R. 8418, is parallel in language to the Miller bill, and provides for the same sort of procedures and regulations to govern food additives. Rep. O'Hara sponsored the legislation as chairman of the subcommittee having jurisdiction over bills affecting the Food and Drug Administration.

•

Amer. Potash Plant Visited

American Potash & Chemical Corp. recently played host to more than 40 chemical industry leaders from the San Francisco area who visited the company's main plant at Trona, Cal. The officials saw how American Potash produces potash and other chemicals from brine pumped from 40 wells sunk into a lake bed. The group also took a look at the community of Trona, where the company's employees and their families live.

•

Riverdale Names Carroll Mgr.

John V. Carroll was recently appointed manager of the Minneapolis office of Riverdale Chemical Co. For the past two years, he has been the representative in Iowa.

•

Stauffer Advances Melander

Promoted to the post of export sales division manager of Stauffer Chemical Co. last month was Milton W. Melander, who joined the company in 1923. He had been Pacific Coast manager since 1942. Melander's headquarters will be in Stauffer's New York offices.

•

Gurney Secretary of ESA

Ashley B. Gurney, recently appointed executive secretary of the Entomological Society of America, has been active in the national and local entomological societies for several years. In 1954, he was elected president of the Entomological Society of Washington. His past chief interest centered on taxonomy, including field work in most of the western states in connection with the biology and distribution of grasshopper species. Mr. Gurney has been associated since May 1936, with the division of insect identification and detection, Entomology Research Branch, USDA.

ASHLEY B. GURNEY

To Study Malaria Control

The sales director of Michigan Chemical Corp., Alfred G. Raufer, will study the operation of the malaria control program being conducted by the World Health Organization in Central and South America. Raufer will make a six-week tour of nine countries in the area, in an attempt to get new information leading to better products for malaria control. The company is a major producer of the 75 per cent wettable DDT powder used in the program.

•

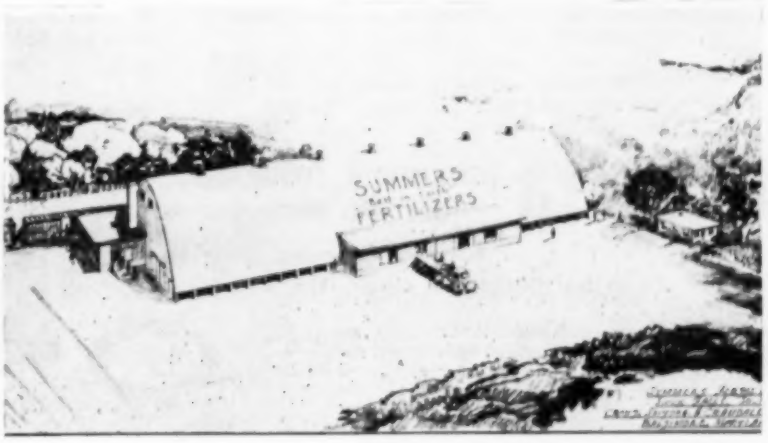
Named to Chase Sales Staff

Donald W. Douglas of Stockton, Cal., has been appointed a salesman for Chase Bag Co., R. R. Koch, manager of Chase in Los Angeles, announced. Douglas will cover the Stockton area and the state of Nevada.

Summers Plant Operating

Performance of the new Summers Fertilizer Co. plant at Sioux Falls, S. D., is fully up to expectations, James E. Totman, Summers president, reported this month. Totman, who heads the company at its home office in Baltimore, said the South Dakota plant has been in operation for several months and is the only modern complete mixing plant in the state. Bulk materials are unloaded by payloaders and fed to an elevator delivering to a conveyor belt installation for distribution to the correct storage bins.

Machinery for the plant was furnished by Stedman Foundry & Machine Co. of Aurora, Ind. and is designed around a two-ton mixer arranged to produce a semi-granular product. A St. Regis 327 valve packer is part of the installation. W. A. Stolt, manager at Summers' Grand Forks, N. D. plant since 1948, has moved to Sioux Falls as general manager of both plants. A. J. Klaverkamp is assistant manager and Gordon Salmonson is field representative.



FOR *REAL PROTECTION* WHEN YOU NEED IT MOST!

Wet weather is scab weather. That's when spores are shooting, when danger of severe infection is greatest. And that's just when *dusting in the rain* with Kolodust gives your trees protection you can get in no other way!

Kolodust is the *only* material that penetrates rain drops and adheres to foliage, buds or fruit both *during and after* the rain. With a Niagara orchard duster and Kolodust you are no longer at the mercy of the weather.

Kolodust is absolutely safe, permits your trees to function normally, producing finer fruit finish and more buds for next year's crop.

And Kolodust goes on *fast*. With a powerful Niagara Liqui-Duster you can Kolodust a large acreage of orchards in a very short time. Remember, you can Kolodust when bad weather bogs down heavy sprayers and keeps them in the barn!

So stop scab troubles before they can start—this spring, and every spring from now on. KOLODUST in the rain for *real* scab protection when you need it most. With such "on-the-nose" timing, you'll profit in bigger, finer packs of more profitable fruit!

50 YEARS OF SERVICE

Niagara

INSECTICIDES, FUNGICIDES, ORCHARD DUSTERS

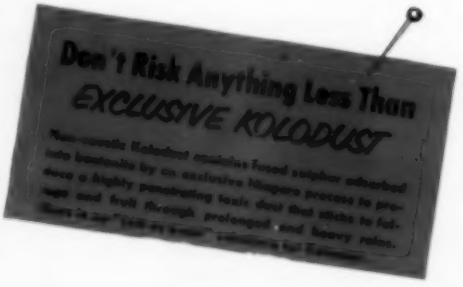
Niagara Chemical Division

FOOD MACHINERY AND CHEMICAL CORPORATION

Middleport, N.Y., Richmond, Calif., Jacksonville, Fla., Tampa, Fla., Pompano, Fla., Wyoming, Ill. New Orleans, La., Ayer, Mass., Greenville, Miss., Harlingen, Tex., Pecos, Tex., Yakima, Wash., **Subsidiary:** Pine Bluff Chemical Co., Pine Bluff, Ark. **Canadian Associate:** NIAGARA BRAND SPRAY CO., LTD., Burlington, Ontario.

WHEN YOU BUY Niagara YOU BUY PROTECTION

fmc Trade Mark



New Rose Pesticide

Swift & Company, Plant Food Division, announced recently the latest addition to its "Vigoro" family of home gardening aids. The newcomer is "End-O-Pest Rose Dust."

Formulated with Malathion, Captan, Karathane, and DDT, End-O-Pest Rose Dust is reported to control all chewing and sucking insects and fungus diseases attacking roses. The manufacturer indicates that the product controls powdery mildew and red spider, and is equally effective on aphids, rose midge, rose chafer, rose curculio, Japanese beetle, rose slugs, black spot, anthracnose and all other rose insects and fungus diseases.

It will be available at garden supply stores this spring, in a 10-ounce refillable dust gun and a 3-pound bag.

Western Cotton Conf. Apr. 13

The cotton disease situation in the far west is to be the featured topic at the third annual Western Cotton Production Conference, April 13-14, in Phoenix, Ariz. Conference speakers pointed out that during 1953 in California, cotton farmers produced 1,725,000 bales. Without plant diseases which attacked last year's crop, they probably would have produced another 487,000 bales.

Diseases most seriously affecting the Texas portion of the Cotton Belt include verticillium wilt which causes plants to shed its leaves prematurely; root rot, bacterial blight, seedling diseases, and root knot. Discussions dealing with these problems were included in the annual program.

Farmers, representatives of the chemical industry, vocational agricultural instructors, county agents, land-grant college representatives, agricultural aerial applicators and many others were scheduled to consider such projects as breeding seed for disease resistance; chemical treatment of seed, soil, and plants for disease control; and closer examination of the nature of the diseases affecting Western cotton production.

Speakers at the two-day meeting also stressed insect control, weed control, and defoliation practices. The conference is sponsored jointly by the Arizona Cotton Growers Association, host to the meeting; Five States Cotton Growers Association; and the National Cotton Council.

•

2,4-D Equipment Needed

Members of the pesticide industry heard a plea for better equipment for applying 2,4-D and more care in using the weed killer at a recent meeting of the National Cotton Council in Shreveport, La.

Attending the meeting were representatives of USDA, land-grant colleges, rice and cattle growers, state regulatory officials, custom applicators, the Civil Aeronautics Administration and the cotton industry.

Suitable means of utilizing 2,4-D for controlling weeds and brush without damaging cotton were discussed. The Cotton Council said the representatives indicated new chemicals, more selective in their action against weeds, are needed by cotton growers.

•

Seed Treatment Recommended

Farmers were reminded this spring by the National Cotton Council that a thorough job of seed treatment helps prevent seed decay and damping-off caused by seed- and soil-borne organisms. This practice aids growers in reducing damage from such diseases as anthracnose, bacterial blight, and sore-shin.

In selecting materials for treating fuzzy, acid-delinted or mechanically-delinted seed, growers should choose compounds approved by local agricultural authorities. Ceresan, an organic mercury compound, has been generally recommended for many years. Another widely used material is Dow 9-B. Other compounds which have given promising results include Spergon, Arasan, Agrox, Setrete, Ortho Seed Guard, Vancide 51, and Seedox.

•

Marietta Names Sales Reps.

Marietta Concrete Corp., manufacturers of concrete farm and industrial storage silos, announced recently appointments of new sales representatives. These are: Mayer & Oswald, Chicago; Matt A. Doetsch Machine Co., Washington, D. C.; Alcar Builders Specialties, Inc., Philadelphia; and Critz Engineering Co., Cincinnati. The new offices will supplement those already maintained at the company's branch plants at Baltimore; Hollywood, Fla., Charlotte, N. C.; and one that will start operations at Bowling Green, Ky., sometime in April.

•

New Illinois Fert. Plant

Illinois Farm Supply Co., an affiliate of the Illinois Agricultural Association, announced last month plans for the construction of a new fertilizer plant, near Tuscola, Ill. Construction is scheduled to begin in May or June, and the plant is expected to be in operation in January, 1955. It is designed to produce 50,000 tons of high-analysis granular mixed fertilizer annually.

•

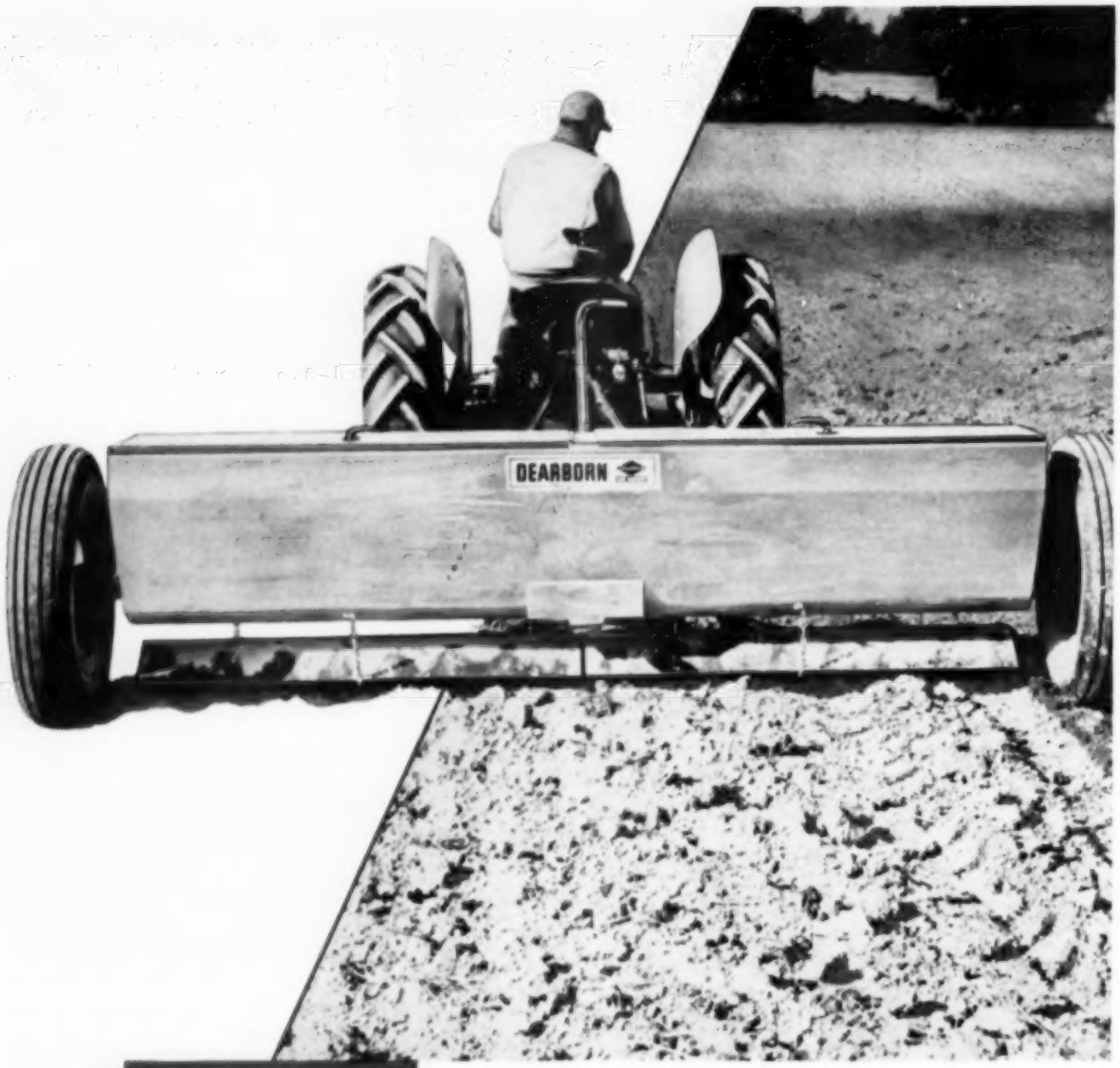
Fulton Bag Advances Three

Fulton Bag and Cotton Mills announced recently executive advances in three main plants. George W. Williams was named manager of operations at Los Angeles; Fred G. Barnet was advanced to manager of the Dallas plant; and Louis J. Even was named sales supervisor at New Orleans.

•

Douglass Leaves Potash Co.

E. W. Douglass resigned April 1st as research director for the Potash Company of America, to engage in engineering consulting. He was with Potash Co. for eight years.



PAY DIRT

The addition of high-analysis fertilizers to the soil produces bumper results come harvest time. High-grade muriate of potash, an important component of these fertilizers, not only enriches the soil, but strengthens crop resistance to disease, producing healthier crops and larger yields.

The high-grade muriate of potash produced by the United States Potash Company has two distinct advantages in the mixing of high-analysis fertilizers. It has the greatest K_2O content and is free-flowing and non-caking—important factors in efficient production.

Adding high-analysis fertilizers to the soil adds up to better profits for farmer and businessman.

SUNSHINE STATE POTASH U.S.A. PRODUCT OF NEW MEXICO

REG. U. S. PAT. OFF.

HIGRADE MURIATE OF POTASH 62/63% K_2O
GRANULAR MURIATE OF POTASH 60% K_2O MIN.

Southern Sales Office
Rhodes-Haverty Building, Atlanta, Georgia

UNITED STATES POTASH COMPANY INCORPORATED
30 ROCKEFELLER PLAZA NEW YORK 20, N. Y.

Smell Gone From Lindane

The smell has been taken out of lindane, Hooker Electrochemical Co. first and largest manufacturer of the insecticide in the United States, reports. The odor, never very noticeable, now has been reduced to an almost infinitesimal degree. California Spray-Chemical Corp. markets lindane for Hooker.

•

Dorr Sets Up Fellowship

The Dorr Co., Stamford, Conn., has set up a fellowship for graduate study in the fields of metallurgical, chemical and sanitary engineering. The fellowship was set up to commemorate the golden jubilee of the invention by Dr. John Van Nostrand Dorr of the Dorr classifier, which was the base on which the company was founded. Fields of the fellowships are those of the principal interests of the company. First fellowship is offered to Rutgers University, of which Dr. Dorr is both a graduate and trustee.

•

New Texas NH₃ Plant

The United Chemical Co. announced recently plans to build an $18,000,000 petrochemical plant at Timpson in East Texas. Completion of the plant, which will manufacture anhydrous ammonia and urea fertilizers, has been set for late in 1955.

•

NFA Presents Pasture Award

Westmoreland County, Virginia, recently was presented with an award by the National Fertilizer Association for outstanding achievement in pasture improvement during 1953, the last of five Virginia counties to be so honored. The Westmoreland presentation was made by Malcolm H. McVickar, NFA chief agronomist, at a meeting of the Ruritan Club in Montrose, Va., March 8. James Latane, chairman of the county pasture committee, received the award.

•

Attapulgus to Merge

Attapulgus Minerals & Chemicals Corp., Philadelphia, and Edgar Brothers Co., Metuchen, N. J., have agreed upon a merger to form a new company, American Minerals & Chemicals Corp. Edgar Brothers produces kaolin.

James Deshler, now president of Edgar Brothers will be chairman of the merged company, and Wright W. Gary, now president of Attapulgus, will be president. David E. Lilienthal now chairman of Attapulgus will become chairman of the executive committee and of the research policy committee.

Diamond Names Evans, Scoville

Two appointments were announced recently by Diamond Alkali Co., Cleveland. C. A. Butler, Jr., formerly director of engineering, has been advanced to the newly-created post of director of commercial development. Loren Scoville, since 1951 vice president in charge of engineering, purchasing and operations for Jefferson Chemical Co., New York, has been named to succeed Mr. Butler as director of engineering.

How Flav-O-Tainers protect your agricultural chemicals longer

If you could take apart a Shellmar-Betner Flav-O-Tainer bag, and examine its construction, you would see why so many packers of agricultural chemicals, insecticides, fertilizers and similar products now depend on it to protect their products.

Flav-O-Tainer is more than a paper bag. Each durable Flav-O-Tainer has a siftproof plastic lining and hermetically-sealed, inner seams. After it has been filled, it can be finally heat-sealed, film to film. That means your dry products stay dry—moist products stay moist. The potency and aroma of non-edible, hydroscopic materials are locked in, while undesirable moisture and oxygen are locked out.

Add to this protection the easy, economical filling and the crisp, colorful printing of the Flav-O-Tainer bag, and you have the compelling reasons for its growing popularity. May we show you how Continental Tailor-Made Package Service can help you?

CONTINENTAL CAN COMPANY

SHELLMAR~BETNER

FLEXIBLE PACKAGING DIVISION

MT. VERNON, OHIO

F. H. LUDINGTON, JR.

Chase Bag Advances Four

Four top executive advances in the Chase Bag Co., Chicago, were announced by F. H. Ludington, president: F. H. Ludington, Jr., assistant vice president, was elected vice president. W. N. Brock was elected vice president and general sales manager; A. H. Nuhn was elected vice president, and M. J. Bender was elected secretary.

•

Phillips Completes NH_3 Plant

Phillips Petroleum Co., Bartlesville, Okla., announced recently that it has practically doubled its production of anhydrous ammonia with the start-up of a new 450-ton per day plant recently completed at Adams Terminal, Texas. Phillips announced also that a new 405-ton per day triple superphosphate fertilizer plant was being put in operation at Adams Terminal, adding another element of plant food to Phillips' fertilizer products.

•

Cyanamid Appoints Felch

D. H. W. Felch has been appointed as Far Eastern representative by American Cyanamid Co., New York. He will be concerned with the Far East activities of the company's agricultural chemicals division and other Cyanamid divisions, with interests in that section of the world. His headquarters will be in Tokyo.

•

Mathieson Reports '53 Gain

Mathieson Chemical Corp., Baltimore, again set new records in 1953 in both sales and income, according to the company's annual report. Sales for the year were $243,575,544 compared with $147,109,581 in 1952.

Commenting on the year's results, T. S. Nichols, president and chairman, said that all of the company's divisions . . . industrial chemicals, agricultural chemicals, hydrocarbon chemicals and drugs registered gains over 1952.

Diamond AgChem Sales Down

Sales of Diamond Alkali Co., Cleveland, reached a record high of $86,734,279 in 1953, an increase of 13% over 1952, according to a report to shareholders made public recently. However, a sharp decline was reported in volume of agricultural chemicals sold by the company. The increase in *total* sales was due partly to a rising volume of some of the company's newer products.

Phillips supplies NITROGEN in 4 forms

1 AMMONIUM SULFATE

New Premium Quality Phillips *66* Ammonium Sulfate is available *now!* It's *dry*-cured to remove excess moisture—prevent caking. Uniform, dust-free crystals flow freely—mix easily. Contains 21% nitrogen, ideal for all analyses of mixed goods and for direct application to all farm crops. Contact us now for your requirements.

2 ANHYDROUS AMMONIA

Tank car shipments of Anhydrous Ammonia (82% nitrogen) are assured to Phillips contract customers by Phillips huge production facilities in the Texas Panhandle and at Adams Terminal near Houston. Write our nearest Division Office for full information.

3 NITROGEN SOLUTIONS

Get more N per dollar! Phillips *66* Nitrogen Solutions are well suited to the preparation of high-analysis fertilizers and the ammoniation of superphosphate. These three nitrogen solutions keep handling costs low! Promote rapid, thorough curing!

4 AMMONIUM NITRATE

Phillips *66* Prilled Ammonium Nitrate contains 33% nitrogen. The small, coated prills or pellets resist caking . . . handle easily. Depend on Phillips *66* Prilled Ammonium Nitrate for uniform, free-flowing properties and top-notch crop response.

PHILLIPS CHEMICAL COMPANY

A Subsidiary of Phillips Petroleum Company, Bartlesville, Oklahoma.

Offices in:

AMARILLO, TEX.—*First Nat'l Bank Bldg.*
BARTLESVILLE, OKLA.—*Adams Bldg.*
CHICAGO, ILL.—*7 South Dearborn St.*
DENVER, COLO.—*1375 Kearney Ave.*
DES MOINES, IOWA—*606 Hubbell Bldg.*
HOUSTON, TEX.—*1020 E. Holcombe Blvd.*
INDIANAPOLIS, IND.—*1112 N. Pennsylvania St.*
KANSAS CITY, MO.—*500 West 39th St.*
MINNEAPOLIS, MINN.—*212 Sixth St. South*
NEW YORK, N. Y.—*80 Broadway*
OMAHA, NEB.—*WOW Building*
PASADENA, CALIF.—*604 Citizens Bank Bldg.*
SALT LAKE CITY, UTAH—*68 South Main*
SPOKANE, WASH.—*E. 521 Sprague Ave.*
ST. LOUIS, MO.—*4251 Lindell Blvd.*
TAMPA, FLA.—*1506 South Dale Mabry*
TULSA, OKLA.—*1708 Utica Square*
WICHITA, KAN.—*501 KFH Building*

Eston Names Montfort

Kenneth W. Montfort of Portland, Ore., has been named district sales manager in the Pacific North-

KENNETH W. MONTFORT

west for the Agricultural Chemicals Department of Eston Chemicals Division, it was announced last month by William J. F. Francis, general sales manager, Western, of American Potash & Chemical Corporation. Mr. Montfort formerly held an executive sales position with Pennsylvania Salt Manufacturing Co. of Washington.

Montfort will direct activities of the department in Oregon, Washington, Idaho, Montana and the Province of British Columbia. He will be assisted by Carl Brown at Wenatchee, Wash., and A. B. Davenport in Yakima, Wash.

•

Nelson Joins Va. Smelting

Paul A. Nelson was recently appointed southeastern sales representative for the Aerosol Division of Virginia Smelting Co., West Norfolk, Va. He was formerly with the Agricultural Chemical Division of American Cyanamid Co., New York.

•

Cotton Recommendations

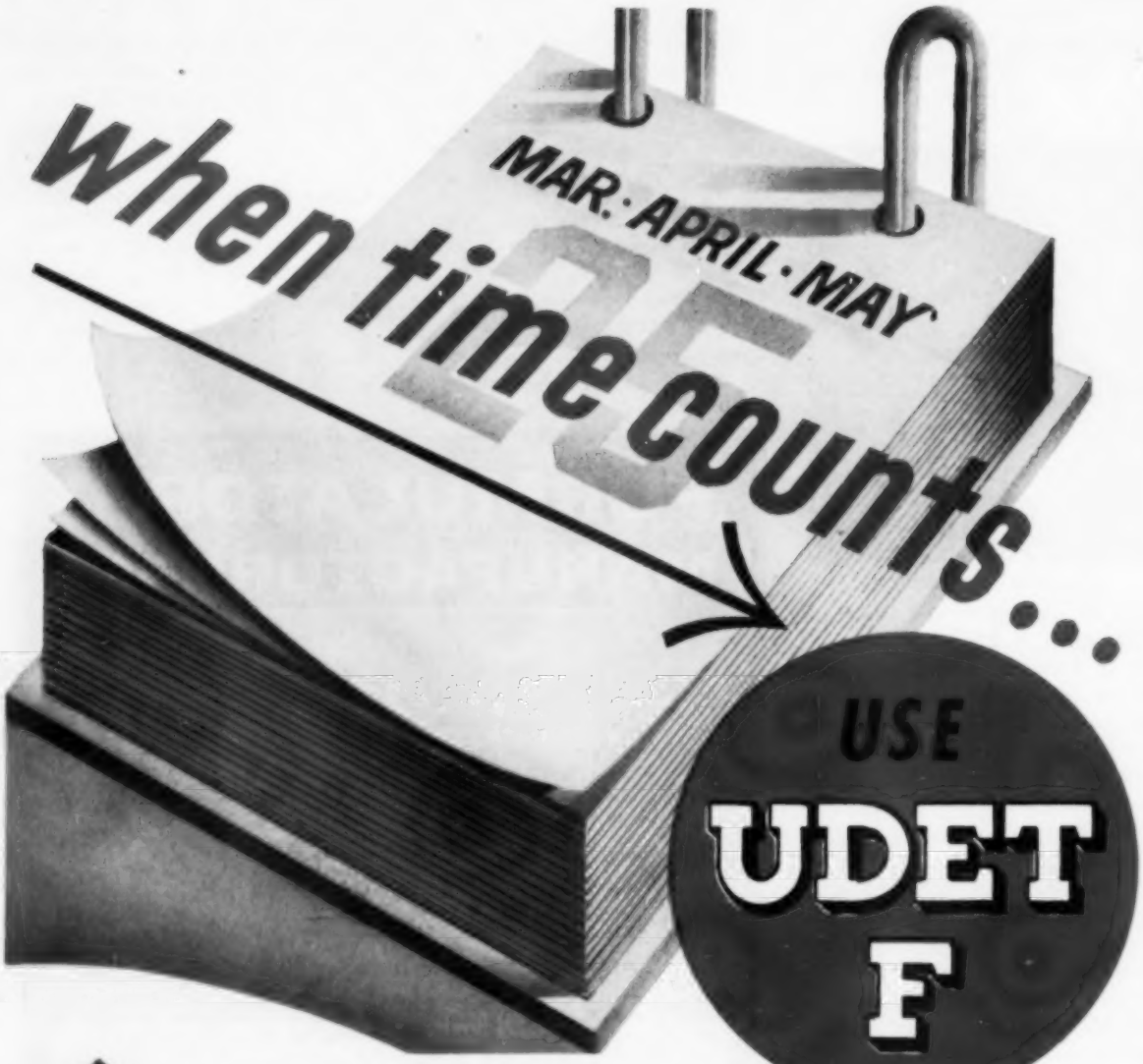
Official recommendations for cotton insect control in 1954 were released recently by the National Cotton Council. The recommendations were assembled from data supplied by state and federal agricultural authorities. They are designed to aid commercial personnel concerned with manufacturing, distributing, or applying pesticides; research and educational workers in each Cotton Belt state and in the Department of Agriculture; and other persons interested in cotton insect control in more than one state, Mr. Welch, director of the council, said.

Special features include a section on precautions for handlers and users of insecticides and another section listing guides for their use. Principal insecticides and recommended rates of application are broken down in chart form for states comprising the Cotton Belt. A complete list of state extension and research entomologists also is included.

•

Dolge Offers New Herbicide

C. B. Dolge Co., Westport, Conn., has issued a bulletin describing its "NP Weed Killer." Reported to be non-flammable and non-corrosive, the product is non-selective. It may be applied either as a spray or powder.



Now, this Spring, when peak production is your goal, use UDET F and get: Faster curing. Easier handling of materials. Faster milling and screening. Minimum "down" time.

Maintain maximum production. And deliver a fully-cured product, practically free from caking, for continued customer satisfaction.

Use UDET F, the *one* surfactant *proved* by fertilizer makers in conclusive tests!

UDET 95F — a 95% active granular powder
UDET 50F — a 50% active free-flowing liquid

IN ACIDULATION, UDET F is up to 3-times more effective than competing products in the presence of calcium ions.

IN AMMONIATION, UDET F, being instantly soluble, disperses completely in the mix. Permits higher absorption of ammonia.

IN GRANULATION, UDET F inhibits cake build-up and equipment fouling. Increases production through less "down" time.

IN AMMONIUM SULFATE PRODUCTION, UDET F lowers moisture content. Provides anti-caking properties.

STOCKS AVAILABLE AT LOCAL WAREHOUSES

Eastern Distributors:
PHILIPP BROTHERS
CHEMICALS, INC.
37 Wall Street
New York 17, New York

Midwestern Distributors:
THOMPSON-HAYWARD
CHEMICAL CO.
18 Branch Offices
Headquarters: Kansas City, Mo.

UNIVERSAL DETERGENTS, INC.
1825 East Spring Street, Long Beach 6, California

U D E T

Division, PETROCHEMICALS CO.
Danciger Building, Ft. Worth, Texas
Eastern Sales Office: Graybar Bldg.
420 Lexington Ave,, New York 17, N.Y.

Suggestions Offered for Handling Parathion Drums

THE dangers involved in handling "empty" Niran drums have led Monsanto Chemical Co. to outline a new policy to help safeguard its customers.

Empty drums, used for Niran*, Monsanto's trade name for parathion, constitute a "serious hazard," the company has found. Under the recently announced plan, the company is allowing its customers a credit of $1.75 to enable them to remove most of the residual parathion by one of several methods. After this, the drums can be punctured and sold to scrap metal dealers or reused for other poisonous substances, which, in the opinion of authorities, would be safe.

Highlight of a Monsanto report on the situation is that "decontamination by any known method will not make the drums safe for general use." The company says it has become quite concerned over the hazards resulting from unsafe disposition of drums which have been used for Niran.

According to tests and calculations made at Monsanto, the average 55 gallon drum which has contained straight parathion will, after careful drainage, still contain approximately one pint of material. In addition, the company found that many supposedly empty drums returned to it contained material on the outside. Handling of such containers could lead to very serious consequences, it stated.

"In spite of our labels and precautionary wording, customers or shippers are careless in tightening plugs," the report stated. "Also," it went on, "it should be borne in mind that the ICC Regulations require the removal of the Class B poison label on the return of an 'empty' container. Then, too, in many cases the manufacturer's warning label or decal is removed or defaced so that there is no label on these empty drums to show transportation personnel that the drums had contained a poisonous liquid. We therefore believed that the return of empty drums constitutes a serious hazard.

*Niran, Monsanto's parathion, is described in technical bulletin 0-52, available from the company.

SHELLMAR-BETNER · Flexible Packaging Division of Continental Can Co. has announced appointment of three men to its staff. O. D. Carlson is manager of sales, C. V. Ore is district sales manager for the Northern Pacific area and T. H. Morris is district sales manager for the Southern Pacific area. Shellmar-Betner offices are located in South Gate, Cal.

International Paper COMPANY

BAGPAK DIVISION

BRANCH OFFICES: Atlanta · Baltimore · Chester Springs, Kansas · Boston · Chicago · Cleveland · Dallas · Denver · Detroit · Kansas City, Kansas · Los Angeles · Louisville · Minneapolis · New Orleans · Philadelphia · Pittsburgh · St. Louis · San Francisco · IN CANADA: The Continental Paper Products, Ltd., Montreal, Ottawa, Toronto

News Brevities

FARM FERTILIZERS, INC., of Omaha, Neb., is adding the continuous ammoniation process developed by TVA to its operations, R. E. Bennett, president, announced last month. The expansion, to be completed this summer, follows closely a recently completed addition to the Omaha plant, Mr. Bennett said. Farm Fertilizers was one of the pioneer manufacturers of granulated mixed fertilizers in the Midwest.

•

E. WILLIAM EIPPER has joined the market research and development department of Stauffer Chemical Co., and associated companies. Formerly with Standard Oil of California, Eipper will be responsible to Paul Brallier, director of the department, with headquarters in San Francisco.

•

NEWLY INCORPORATED in the agricultural field is Marl Grow Mineral Co., a manufacturer of chemical fertilizer at Stanford, Ky.

•

A GRANGE LEAGUE FEDERATION fertilizer plant, utilizing latest mixing machinery, has been opened by the organization at Union City, Pa.

•

THE NEW FERTILIZER material, ammonium nitrate phosphate, cannot be handled in the port of Baltimore, the Port Security Council ruled recently. The council took the action on recommendation of Capt. E. W. Holtz, captain of the port, who told the group the Coast Guard had placed stringent restrictions on the mixture, because little is known about it. Ammonium nitrate phosphate was released for handling several months ago.

•

KENNETH H. ALLEN has been promoted to director of purchases by Stauffer Chemical Co., Hans Stauffer, executive vice president, announced last month. Allen joined Stauffer in 1944 as purchasing agent for the company's western operation. His new headquarters is in New York.

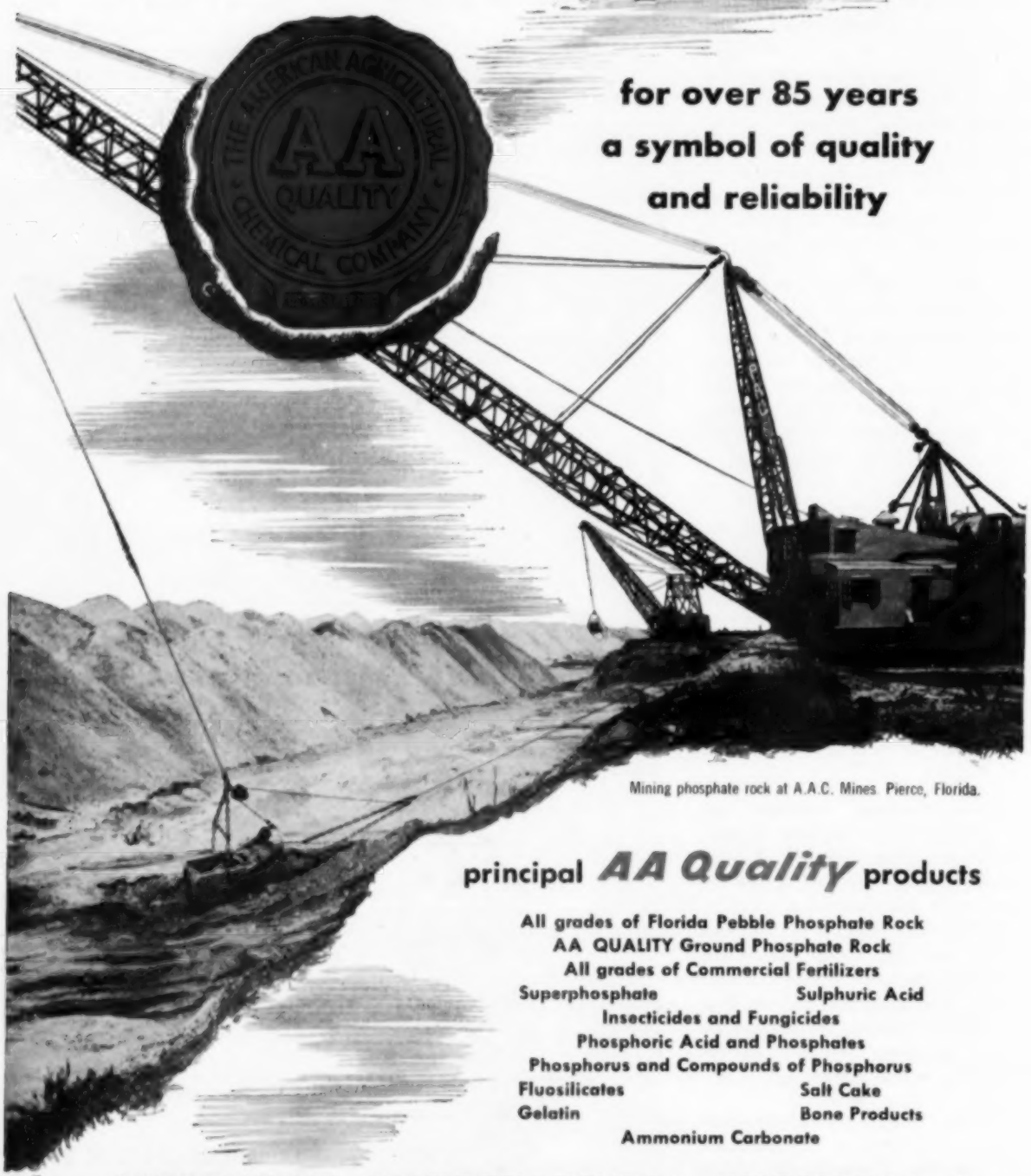
•

A SPECIAL PRESS preview of the new Brea Chemicals, Inc., ammonia plant and aqua ammonia soil nutrition service was held March 26 at Brea, Cal., with a tour of the $13 million plant featured. A field demonstration of new equipment and methods for storing, handling and applying ammonia was included on the program.

•

ROHM & HAAS CO., of Philadelphia, is building a Canadian plant at Scarboro, near Toronto, to be managed by Rohm & Haas Co. of Canada Ltd. The plant will be part of an expanded program to serve agriculture in that country.

AA Quality...



for over 85 years
a symbol of quality
and reliability

Mining phosphate rock at A.A.C. Mines Pierce, Florida.

principal *AA Quality* products

All grades of Florida Pebble Phosphate Rock
AA QUALITY Ground Phosphate Rock
All grades of Commercial Fertilizers
Superphosphate — Sulphuric Acid
Insecticides and Fungicides
Phosphoric Acid and Phosphates
Phosphorus and Compounds of Phosphorus
Fluosilicates — Salt Cake
Gelatin — Bone Products
Ammonium Carbonate

The AMERICAN AGRICULTURAL CHEMICAL Co.

GENERAL OFFICE: 50 CHURCH STREET, NEW YORK 7, N.Y.

33 FACTORIES AND SALES OFFICES, SERVING U.S., CANADA AND CUBA—ASSURE DEPENDABLE SERVICE

Suppliers' BULLETINS

Fertilizer-Weed Killer

A new product for the home-garden market will be offered re-

tailers this season by American Cyanamid Co. in "Lawn and Garden Cyanamid," reported to kill weed seed when first applied to the soil, and then converting into a fertilizer. The manufacturer indicates the product builds soil humus, repairs weedy lawns, and makes compost. Manufactured as a granular product, "Cyanamid" is available in 10, 25 and 50 pound bags.

•

Soil Fumigant Leaflet

A leaflet outlining use of "Bromofume," a soil fumigant used in control of wireworms, nematodes, and other soil pests, is offered by Eston Chemicals Division of American Potash & Chemical Corporation, Los Angeles, Calif. Application of Bromofume to the soil releases bromine vapors which are diffused to a depth of from 12 to 18 inches, killing the crop-destroying pests. It is reported to be particularly effective when applied ahead of plantings of potatoes, beans, tomatoes, lettuce, carrots, sugar beets, melons, onions, and cotton.

•

DuPont Fungicide Bulletins

E. I. duPont de Nemours & Co., Wilmington, issued two bulletins in March, dealing with fungicides "Manzate" and "Fermate." The Manzate booklet reviews use of this product on tomatoes, in control of five major fungus diseases. The manufacturer points out that Manzate shows promise also for use on crops such as cucumbers, cantaloupes and other cucurbits. In the bulletin on Fermate, apple growers report favorable results in control of scab, rust diseases and other apple fungus diseases.

•

New Faesy-Besthoff Booklet

Faesy & Besthoff, Inc., New York, manufacturer and distributor of garden and home agricultural products, has published a new leaflet describing the properties and use of "Wizard Brand" sheep and cow manure, "Longhorn Brand" cattle manure and "Ramshorn Brand" sheep manure. The company is national sales agent for the three products.

•

Armour Surfactant Literature

Armour & Co., Chicago, offer a new booklet, "Etho-Chemicals", which describes surfactants and emulsifiers used in insecticides, herbicides, emulsions, etc. Physical and chemical properties of the compounds are listed, and selections and industrial application are described. Actual insecticide, herbicide and emulsion formulas are also given.

New Bin-Dicator Catalog

A new catalog describing and illustrating the company's products was issued recently by the Bin-Dicator Company, Detroit. Bin-Dicator manufactures a complete line of pressure-actuated bin level indicators which are used as a simple means of indicating the level of granular, pulverized and semi-liquid materials stored in tanks, silos, hoppers and bins.

•

Wheelabrator Dust Collector

Fertilizer manufacturers who have dust problems in their plants may be interested in a bulletin from American Wheelabrator & Equipment Co., describing that firm's line of dust collecting equipment.

The company says many plants in the industry already are using its dust collecting equipment. Complete descriptions of equipment for eliminating the problem of dust in formulating plants may be obtained from American Wheelabrator at Mishawaka, Ind.

•

Com-Bin for Crushing

A new use for the Com-Bin Feeder, manufactured by Pulva Corp., 550 High St., Perth Amboy, N. J., is described in literature available from the company.

Pulva says its unit now can be used for crushing; eliminating bridging, providing surge bin capacity and ending the need for any pre-crushing operation. This feeder has application in many phases of the agricultural chemicals industry. Company literature describes uses and specifications of the feeder.

New Phelps Dodge Booklet

A booklet describing a simple method of treating fence posts against decay and termites is being offered by Phelps Dodge Refining Corp., New York. The method was developed at the Forest Products Laboratory of the U. S. Department of Agriculture's Forest Service. Suggested treatment involves use of copper sulfate and sodium chromate, and is said to be of particular value in areas where commercially-treated posts are not readily available.

•

New Fischbein Bag Closer

Dave Fischbein Co., Minneapolis, has recently gone into production on a new model portable bag closer, which handles all paper bags, including 5 and 6 ply multi-wall gusseted types, as well as textile bags with or without asphalt lamination. One of the new construction features is a trigger-style switch and an automatic stop.

•

G.L.F. Weed Control Guide

A 46-page guide on chemical weed control for the dairyman, vegetable grower and farm home was issued recently by the Cooperative G.L.F. Exchange, Inc., Ithaca, N. Y. The booklet lists several chemicals and rates of applications for weed control on grasses, fruit and vegetable crops. Application equipment, sprayers and nozzles are described also.

•

Anhydrous Ammonia Data

The newly formed fertilizer section of the National Safety Council recently published Data Sheet D-251 on anhydrous ammonia. The bulletin details physical and chemical properties, shipping data, toxicology facts, storage suggestions, and equipment requirements.

•

Dealer Folder Ready

Melnor Products Co., New York City, have announced recently a dealer aid folder of promotion tools. The booklet lists a variety of promotional materials such as wrap-around displays, newsmats, envelope enclosures, streamers, photos, etc.

Phillips Describes Market

The growing fertilizer market is described in a pamphlet prepared by Phillips Petroleum Co., Bartlesville, Okla. and distributed to the company's 85,000 stockholders with recent dividend checks.

The pamphlet outlines the increased usage of fertilizer in the past 10 years and tells Phillips' part in the growing field. Phillips entered the fertilizer picture in 1948, when the ammonia plant in the Texas Panhandle was placed in operation and an ammonium sulfate plant was started.

•

Booklet on "Telvar" W

A booklet describing the effectiveness of "Telvar" W, DuPont's new name for its CMU herbicide, has been issued by the company. Printed in full color, the booklet shows the effectiveness of the material along railroad right of ways and around industrial buildings for controlling weeds. Copies are available from the company.

•

Varco Barrel Pump

A new Varco barrel pump, which fits either standard two inch or one and one-half inch drum openings has been developed by James Varley & Sons, Inc., St. Louis.

The pump can be attached to 55, 30 or 15 gallon drums, because it has a collapsible steel suction pipe, Varley states. It can be used for pumping either thick or thin liquids.

•

New Hough Capacity Data

The Frank G. Hough Co., Libertyville, Ill., announced recently new listings of capacity for all models of the payloader. Both "struck-load" and "pay-load" capacities are identified.

•

Pest Control Booklet

A 66-page booklet "Modern Pest Control," prepared and published by Green Cross Products, Montreal, Que., contains illustrations of insect pests, fungus diseases and weeds, with information on identification and control. Modern dusting and spraying methods are reviewed also. The Sherwin Williams Co. of Canada, Ltd., is among the distributors of this literature.

•

Phillips Develops Plastic

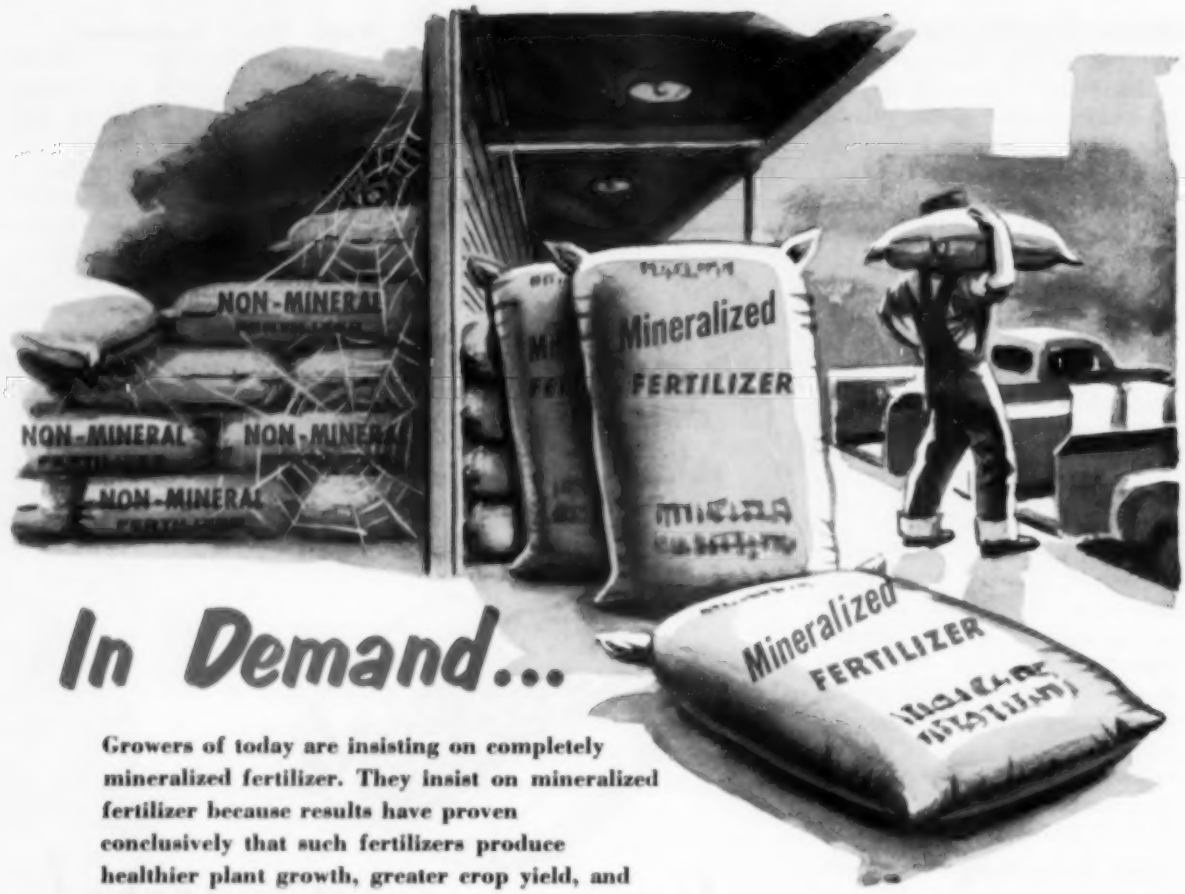
A new type of polyethylene plastic, said to be superior to other products, has been developed by Phillips Petroleum Co. The product will be manufactured by the company at a plant to be built at Adams Terminal on the Houston Ship Channel where the company is expanding its petrochemical manufacturing facilities.

The plastic will be used to coat paper and for other purposes.

Conn. Marks Anniversary

The 100th anniversary of research on insect control in the United States was marked March 19 with an anniversary meeting at the Connecticutt Agricultural Experiment Station. It was arranged by the New Haven Entomological Society, which, along with other entomological organizations, is celebrating this year the 100th anniversary of the founding of the profession.

The program included an address on industrial research in entomology and related fields by Dr. J. W. Zukel, entomologist and biologist at the Bethany Laboratories of Naugatuck Chemical Co.



In Demand...

Growers of today are insisting on completely mineralized fertilizer. They insist on mineralized fertilizer because results have proven conclusively that such fertilizers produce healthier plant growth, greater crop yield, and increased dollar profits per acre.

The addition of the essential minerals to your fertilizer will stimulate fertilizer sales, produce more satisfied customers, and increase tonnage and dollar profits.

We are basic producers of minerals and would like to discuss with you how fertilizer tonnage and profits can be increased through the addition of the essential minerals.

For detailed information, phone, wire or write—

TENNESSEE TC CORPORATION

617-29 Grant Building, Atlanta, Georgia

COPPER SULPHATE
ZINC SULPHATE
MANGANESE SULPHATE
MAGNESIUM SULPHATE
BORON
FERRIC IRON SULPHATE

SOLUBLE TRACE MINERALS

Tennessee's trace minerals are soluble and their nutritional value is immediately available to the plant. Soluble trace minerals are more economical and faster acting.

TENNESSEE TRI-BASIC COPPER SULPHATE

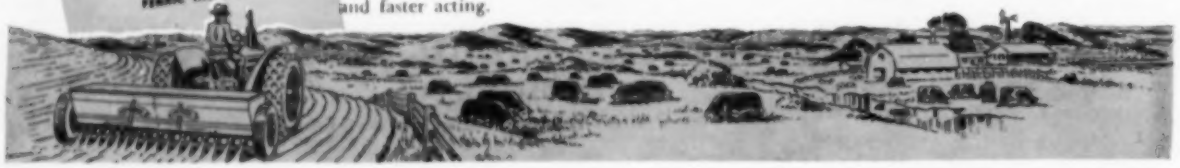
TRI-BASIC Copper Sulphate is a chemically stable copper fungicide containing not less than 53% metallic copper. TRI-BASIC Copper Sulphate can be used as a spray or dust on practically all truck crops and citrus crops. Control persistent fungus diseases — correct copper deficiencies from a nutritional standpoint. Use TC TRI-BASIC Copper Sulphate.

COP-O-ZINK

COP-O-ZINK is a new, neutral copper-zinc fungicide containing 42% copper and 11% zinc. COP-O-ZINK gives a superior performance in control of fungus diseases. COP-O-ZINK composition of two essential elements gives it added value in correcting deficiencies of zinc and copper and in stimulating plant growth. COP-O-ZINK is compatable with all inorganic and organic insecticides. No lime is required. For use in spraying or dusting.

NU-Z

NU-Z contains 55% metallic zinc. It is a neutral zinc compound, which does not require the addition of lime for direct foliage application. NU-Z gives excellent coverage and adherence to plant foliage, thus rendering it available over a longer period of time. Safe for direct application. For zinc deficiency and plant nutrition — use as spray or dust.



INDUSTRY *Patents*

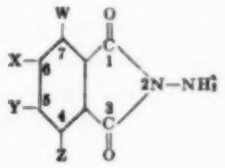
The information below is furnished by patent law offices of

LANCASTER, ALLWINE & ROMMEL

402 Bowen Building
Washington 5, D. C.

The data listed below is only a brief review of recently issued pertinent patents obtained by various U. S. Patent office registered attorneys for manufacturers and/or inventors. Complete copies may be obtained direct from Lancaster, Allwine & Rommell by sending 50c for each copy desired. $1.00 for Canada. They will be pleased to give you free preliminary patent advice.

2,657,169. N - Aminophthalic Imides and Salts Thereof as Fungicidal Compositions. Patent issued October 27, to Waldo B. Ligett, Berkeley, Rex D. Closson, Detroit, and Calvin N. Wolf, Ferndale, Mich., assignors to Ethyl Corporation, New York. A fungicidal composition, consisting of a uniform dispersion of an active ingredient, present in amount less than about 50 percent by weight, which is selected from the group consisting of a compound possessing the general formula



and salts whereon, wherein W, X, Y and Z are selected from the group consisting of hydrogen, halogen, nitro and amino, in admixture with an inert fungicidal adjuvant as a carrier therefor.

2,657,167. Chlorinated Terpene Derivative. Patent issued October 27, to Warren L. Walton, Schenectady, N. Y., assignor to Hercules Powder Co., Wilmington, Del. The product of chlorination of a cyclic terpene-polyhalomethane adduct dissolved in an inert solvent with chlorine gas in the presence of a free radical-forming chlorination catalyst at a temperature in the range of 50° to 150° C. and containing from about 54% to 75% chlorine, said adduct being the product formed by heating a cyclic terpene and a polyhalomethane in the presence of a peroxide catalyst.

2,667,717. Spraying and Dusting Machine. Patent issued Feb. 2, to George W. Daugherty, Orlando, Fla., assignor to Food Machinery and Chemical Corp., San Jose, Calif., a corporation of Delaware. An insecticide spraying and dusting machine comprising a support, a supply source for insecticide dust, a supply source for insecticide liquid, a duct of one size extending from the dust supply source to an end of the support to effect a dust stream, a pipe communicating with the interior of the duct and with the liquid supply source to effect a liquid stream, a conduit of several times greater cross sectional area than the said duct and pipe surrounding the ends of said duct and pipe, means for providing an air stream to pass through the conduit, said air stream adapted to encompass the stream of material blowing from the duct and pipe, a supercharge on said support providing a blast of air within said dust duct, and a pump for forcing said liquid in said pipe to pass to and intermingle with said combined dust and air stream, said combined dust, air and liquid stream being discharged toward foliage at a greater distance and over a greater area by said air stream in said conduit, said blast of air being at such speed as to effect substantially complete separation of the dust particles from each other and substantially complete intermingling of the dust particles and liquid insecticide in said air stream.

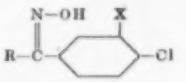
2,668,103. Disulfides as Synergist for 2,4-D. Patent issued Feb. 2, to Lyle D. Goodhue, Bartlesville, Okla., assignor to Phillips Petroleum Co., a corporation of Delaware. A herbicidal composition of matter comprising a compound selected from the group consisting of 2,4-dichlorophenoxyacetic acid and its salts and esters and a compound selected from the group of compounds which can be represented by the general formula

$$R—S—S—R'$$

wherein R and R' are selected from straight and branched-chain alkyl groups, each containing from eight to twelve carbon atoms, and can be different.

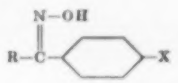
2,668,104. Plant Growth Regulant Compositions Comprising Chloroaryloxyacetic Acids and Esters Thereof. Patent issued Feb. 2, to John D. Eastman, Midland, Mich., assignor to The Dow Chemical Co., Midland, Mich., a corporation of Delaware. A composition for controlling the growth of vegetation which comprises as active ingredients (1) a chloroaryloxyacetic acid in solution in (2) a glycol ether ester of a chloroaryloxyacetic acid, said being present in the amount of at least 4 per cent by weight based on the weight of ester.

2,668,115. Method of Controlling Stem-end Decay and Mold on Citrus Fruits. Patent issued Feb. 2, to Paul A. Wolf, Midland, Mich., assignor to The Dow Chemical Co., Midland, Mich., a corporation of Delaware. A method of treating whole citrus fruit without substantial injury thereto, to protect the fruit against attack by mold and stem-end decay organisms, comprises wetting the fruit with a composition comprising from about 1 to 3 per cent by weight of an oxime in an aqueous alkaline medium, the oxime being characterized by the formula



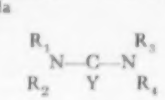
wherein R is a member of the group consisting of hydrogen, methyl and ethyl, and X is a member of the group consisting of hydrogen and chlorine, the aqueous composition having a pH of at least 11.

2,668,116. Method of Controlling Stem-end Decay and Mold on Citrus Fruits. Patent issued Feb. 2, to Paul A. Wolf, Midland, Mich., assignor to The Dow Chemical Co., Midland, Mich., a corporation of Delaware. A method of treating whole citrus fruit without substantial injury thereto, to protect the fruit against attack by mold and stem-end decay organisms, which comprises wetting the fruit with a composition comprising from 1 to 3 per cent by weight of an oxime in an aqueous alkaline medium, the oxime being characterized by the formula.



wherein R represents a member of the group consisting of hydrogen, methyl and ethyl, and X represent a member of the group consisting of methoxy and allyloxy.

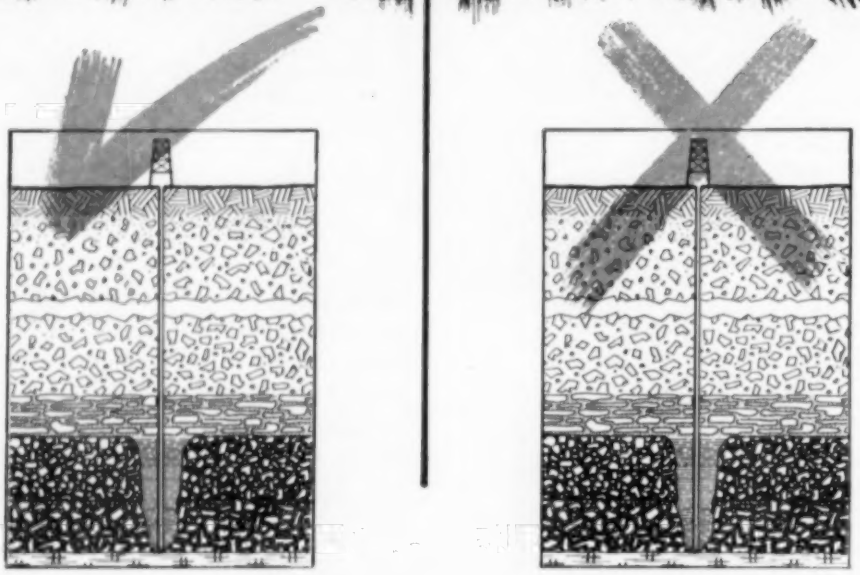
2,668,758. Defoliant Compositions. Patent issued Feb. 9, to Elizabeth S. Roos, Belleville, Ill., and Philip C. Hamm, Webster Groves, Mo., assignors to Monsanto Chemical Co., St. Louis, Mo., a corporation of Delaware. A plant defoliant composition which comprises, as the essential active ingredient, from 0.01% to 10% by weight of a compound having the formula



wherein Y is a chalkogen selected from the group consisting of oxygen and sulfur and wherein R_1, R_2, R_3, and R_4 are alkyl groups; and a fluent carrier containing from 0.1% to 5% by weight of a wetting agent.

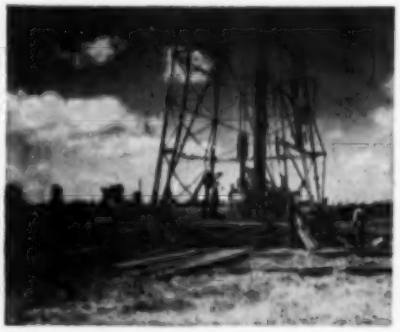
SULPHUR

...why can't *Every* dome produce sulphur?



The production of sulphur in the Gulf Coastal Region of Louisiana and Texas by the Frasch Process, is from underground natural beds found in "domes." However, very few domes have been found to contain sufficient sulphur, if any, to be brought into production.

It is estimated that nearly 200 dome structures along the Coast of the Gulf of Mexico have been investigated over the last half-century but only fourteen have produced sulphur in quantity.



And the presence of sulphur, even in quantity, doesn't always mean a successful producer. Some years ago a dome was found, explored, and proved with the result that a plant for the production of sulphur was erected at a cost of several million dollars. Later it had to be abandoned because the underground conditions did not lend themselves to the use of the Frasch Process.

A dome is a sulphur mine only when it can be worked economically and produce sulphur in commercial quantities.

Texas Gulf Sulphur Co.

75 East 45th Street, New York 17, N. Y.

Sulphur Producing Units

- NEWGULF, TEXAS
- MOSS BLUFF, TEXAS
- SPINDLETOP, TEXAS
- WORLAND, WYOMING

CHEMICAL PROGRESS WEEK-MAY 1957

2,669,585. MANUFACTURE OF CHLORAL. Patent issued Feb. 16, to Lloyd R. Coster, Pine Bluff, Ark., assignor to Food Machinery & Chemical Corp., San Jose, Calif. The batch method of preparing chloral-hydrate of a purity such that it may be used directly in the manufacture of DDT which comprises adding chlorine gas in the absence of a chlorination catalyst to a starting composition consisting solely of ethyl alcohol in the range 95% to absolute alcohol until the specific gravity of the batch is at least 1.44, thereafter adding about 0.50 mole of water per mole of starting ethanol and chlorinating at a temperature higher than that in the first stage until a specific gravity of 1.54 in the batch is reached, then adding about 0.25 mole of water per mole of starting ethanol and chlorinating at a temperature higher than in the second stage and completing the chlorination when the specific gravity of the batch is 1.620 to 1.635 and the temperature 80° C. to 90° C. and withdrawing the chloral- hydrate so formed for use directly in the manufacture of DDT.

2,669,510. FERTILIZER CONDITIONER. Patent issued Feb. 16, to Harry A. Dresser, Chicago, Ill., assignor to Zonolite Co., Chicago, Ill., a corporation of Montana. A free-flowing fertilizer comprising a commercial fertilizer composition in admixture with up to about 1.5% of exfoliated vermiculite.

2,670,282. PLANT GROWTH REGULATION. Patent issued Feb. 16, to William W. Allen, Ambler, Pa., assignor to American Chemical Paint Co., Ambler, Pa., a corporation of Delaware. A process of regulating the growth of plants comprising applying to a plant the compound 3-amino-1,2,4-triazole in a concentration and amount sufficient to regulate plant growth.

TRADE MARK APPLICATIONS

AEROCON, in capitals, for soil conditioner. Filed May 6, 1952, by American Cyanamid Co., New York. Claims use since April 22, 1952.

AEROTIL, in capitals, for soil conditioner. Filed May 6, 1952, by American Cyanamid Co., New York. Claims use since April 22, 1952.

BUGACIDE, in capital letters, underlined, with "A" in larger type, for insecticide for general garden use. Filed Oct. 27, 1952, by Lien Chemical Co., Franklin Park, Ill. Claims use since Sept. 11, 1950.

488, for insect repellent combinations. Filed Oct. 23, 1951 by The Chemical Foundation, Inc., New York. Claims use since June 14, 1946.

AER A SOL, with stars between the parts of the trade mark, for insecticides. Filed March 29, 1952, by Bridgeport Brass Co., Bridgeport, Conn. Claims use since Oct. 3, 1945.

MOTOMCO, Inc. Chemical Specialities, printed around an oval seal with an indian head, for insecticides and rodenticides in liquid and solid form and plastic pellets having water soluble insecticide and rodenticide material deposited on the surface thereof. Filed June 15, 1953, by Motomco, Inc., New York. Claims use since April 28, 1953.

Ho-No-Mo, for weed killer, with drawing of devil and line "Raises the Devil with weeds," disclaimed apart. Filed Feb. 24, 1953, by Spencer Chemical Co., Kansas City, Mo. Claims use since Feb. 7, 1953 as to the complete mark and since Oct. 30, 1952 as to the term "Ho-No-Mo."

TRIMTONE, with large capital "T's," for chemical preparations in solid or liquid form useful for the suppression or retardation of plant growth. Filed March 3, 1953, by American Chemical Paint Co., Ambler, Pa. Claims use since Feb. 23, 1953.

NEMEX, in capital letters, for soil fumigants. Filed April 13, 1953, by Larvacide Products, Inc., New York. Claims use since March 31, 1953.

MYCON, in capitals, for agricultural bactericides and fungicides. Filed July 12, 1951, by Chemagro Corp., New York. Claims use since June 11, 1951.

VALUE OF PESTICIDES

(*From Page 61*)

crops. The abundance and high quality of citrus fruit, apples, pears, plums, cherries, etc., can be credited to the use of insecticides and fungicides. Without them, these crops would undoubtedly be materially shortened in supply and lowered in quality. As a mater of fact, without the use of insecticides on apples and pears it has been abundantly demonstrated that within a few years after the discontinuance of these protecive measures, only a small percentage of the fruit would be marketable. Before the advent of DDT the annual loss charged to the codling moth alone was $50,000,000. Now it is estimated at less than one-fifth that amount.

Truck and garden crops are subject to the attack of many different serious pests. The use of persistent insecticides on these crops has been restricted considerably because of the desirability of reducing residues to a minimum. Nevertheless, through the proper use of these materials, abundant crops of some of the garden species are procured, where total destruction would follow their non-use. For instance, in many parts of the country such pests as the Mexican bean beetle would make profitable bean raising an impossibility without insecticides.

In many areas in the United States the yield of onions has been increased strikingly through the use of insecticides for the control of thrips. This has been particularly true in Idaho and California. In New Mexico the Experiment Station secured an increased yield of 45% by controlling onion thrips with dieldrin. The value of the increased yield per acre in that case was $461.25 while the cost of the material and its application was only $9.00.

A large percentage of the tremendous increase in potato yields in the United States can be credited to the use of insecticides in the control of potato insects. Yields have been more than doubled in a number of areas since the advent of DDT and other effective insecticides, and on the average throughout the United States the increase has been more than 60%. While some of this increase is attributed to improved varieties, proper fertilization, and perhaps other factors, it is quite evident that control by insecticides of the various insects including aphids and the Colorado potato beetle is a dominant factor.

The dependence of the growers of peas on insecticides to control the pea aphid and pea weevil is well known. Untreated fields of peas for drying are often infested with pea weevils to the extent of 70 to 90%. Without insecticides, canning peas would become so weevily as to cause their complete rejection by canneries.

The application of chemicals to soil in fields where beans, potatoes, sugar beets, onions, corn, and other crops are grown is adding billions of dollars to the income of the farmers through the control of wireworms which affect these crops. The value

of such insecticides as aldrin, dieldrin, and heptachlor for the control of the sugar beet root maggot has recently been fully demonstrated. Increased yields of more than 4 tons of beets per acre have been secured. Production of sugar cane has been nearly doubled by controlling wireworms with insecticides.

Tremendous gains in yields of corn through the insecticidal control of the European corn borer and corn earworm have resulted during the last few years. Where formerly it was impossible to raise sweet-corn in the South because of the serious damage inflicted by the corn earworm, insecticides now make it possible to obtain large yields of fancy table corn for early season sale.

The protection of the cotton crop in this country against a dozen serious pests requires a large amount of all sorts of insecticides. Even in areas of high production, free from the boll weevil and pink bollworm, gains in yields of 20 to 30 percent are often obtained from insecticide use. Where the boll weevil and bollworm are prevalent, it is often impossible to make a crop worth picking without several applications of insecticides. Combinations of the pink bollworm and boll weevil are coming to be a serious matter in South Texas. In 1952 the pink bollworm reduced yields in some areas in South Texas by 50 to 90 percent. Experiments that year demonstrated the effectiveness of insecticide. For example, in one test a poisoned area produced 2,345 pounds of seed cotton per acre as compared with 850 pounds on a non-poisoned area—a gain of 1,540 pounds.

Many losses inflicted by insects especially to pastures and forage crops are not recognized, or are attributed to other causes by farmers. The extent of these losses becomes apparent when the offending insects are controlled by insecticides. As an example, entomologists of the Wisconsin Experimental Station found that spending $2.00 for insecticides for the control of a moderate infestation of leafhoppers on alfalfa gave a 50 percent increase in yield. The nutrient value of the hay was increased nearly 60 percent by the treatment and the vitamin A content was nearly doubled. In a heavily infested field the yield was increased 4 times and the nutrients more than 5 times. On the basis of the gain of $6.00 per acre resulting from control of a moderate leaf-hopper infestation which commonly occurs throughout the country, the increased value of the alfalfa hay crop of the United States would be nearly 114 million dollars.

Increases in seed yields of alfalfa, clover, and other legumes through control of Lygus, root weevils, spittle bugs, and other pests have been phenomenal.

Some Contributions of Insecticides

THE availability of abundant supplies of organic insecticides in the last few years has, for the first time, made it possible to prevent outbreaks of insects that destroy forests over thousands of square miles. More

The strength of our line is in the quality of our products

...may we serve you?

To get highest-quality agricultural chemicals, quickly delivered from regional plants and warehouses, call on Wyandotte—a basic producer of raw-material chemicals for 64 years.

- **DDT** (technical)
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- **LINDANE** (free flowing and readily formulated)
- **KREELON*** (alkylarylsulfonate for fertilizers)
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- **SOLVENTS**
- **FUMIGANTS**
- **EMULSIFIERS**
- **SOIL CONDITIONERS**
- **PLURONICS*** (an amazing new series of surface-active agents and emulsifiers)

Wyandotte service-scientists are always available to give you skilled technical assistance on any processing or handling problem.

New product development, product improvement, and customer assistance, all of which directly benefit the people who buy our products, are some of the areas in which Wyandotte service-scientists work. Their aim is the most efficient, practical use of Wyandotte materials in your plant. Your problem can quickly become a research project, if the data is not already available in the store of information we have on your industry.

The advantage of the combination of up-to-the-minute research and quality chemicals shows up best where you like it most—in your profit. Send us your requests for information today. *Wyandotte Chemicals Corporation, Department AC2, Wyandotte, Michigan. Offices in principal cities.*

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CHEMICALS

SODA ASH • CAUSTIC SODA • BICARBONATE OF SODA • CHLORINE • CALCIUM CARBONATE • CALCIUM CHLORIDE • CHLORINATED SOLVENTS
GLYCOLS • SYNTHETIC DETERGENTS • AGRICULTURAL INSECTICIDES • SOIL CONDITIONERS • OTHER ORGANIC AND INORGANIC CHEMICALS

than 1½ million board feet of lumber was saved through the aerial application of DDT to control the Douglas-fir tussock moth on 413,000 acres of timber in the Northwest in 1947; also the control of the spruce budworm on a million acres of forest in Oregon and Washington in 1950. The protection of logs, pulp wood and lumber by applications mostly of BHC has resulted in tremendous savings which are seldom brought to attention.

The livestock and, especially the dairy industries, have insecticides to thank for the great gains in meat and milk production with less consumption of feed.

Probably the greatest contribution of insecticides to the health and welfare of the people of the world is through their use against disease-carrying insects. The elimination of the yellow fever mosquito from the major part of South America and with it the threat of outbreaks of that dread disease is largely credited to the use of insecticides. The hazards of mosquito borne encephalitis are being reduced through mosquito control in which insecticides are playing a major role.

Dysentery and other enteric diseases are greatly lessened through fly control to which insecticides are making an important contribution. Typhus fever that has caused the defeat of armies and has struck down thousands of cilivians is no longer feared because insecticides are being used to wipe out the louse carrier of that dread disease.

The world is organizing an all-out fight against malaria. The United States is now virtually free of this debilitating disease. Italy has the disease under complete control. Greece, Iran, Turkey, India, Burma, Pakistan, The Philippines, Formosa, Liberia, practically all South American countries, and many others are making rapid progress in protecting their people from malaria. Insecticides are the weapons depended upon in all these campaigns.

The saving hand of DDT and other insecticides is reaching out to every land, easing the misery, and preventing the death of millions in far off places, permitting the weak to gain strength, the soil to be tilled, and the shadows of famine to be dispelled. True, population increases may consume the increased yields of corn and wheat and rice. But this can be overcome in time through education and the enlightenment of the people. I regard DDT and the insecticides developed following its discovery by Mueller as among the greatest gifts of science to man.

I have cited but a few examples of how pesticides are raising standards of living and protecting health. From these and hundreds of others that might be pointed out, we are forced to conclude

1. That expense is attached to the use of pesticides, but the gains resulting nearly always far outweigh the expense.

2. That there are some hazards surrounding pesticide use, but these can be largely avoided.

3. That pesticide use is an important element in soil conservation, flood prevention and forest preservation.

4. That without pesticides the quantity and quality of our food, feed and fiber would be drastically cut.

5. That through insecticide use in control of mosquitoes, flies, fleas, lice and ticks, millions of lives are being saved, sickness and misery abated, and the economic status of the world improved.★★

NAC CONVENTION

(*From Page 58*)

two groups of insects—aphids and spider mites. Limited usefulness has been demonstrated against certain mealybugs. Until a wider variety of chemicals has been explored for systemic activity, Dr. Haller commented, it will not be known whether the systemics developed thus far are simply not sufficiently toxic to control other species of insects or whether all systemics are inherently specific for certain insects. To date, no systemic has been registered under the Federal Insecticide Act for use on any food crop, he reported.

A new field which appears to possess considerable promise, the speaker indicated, is the use of chemicals that act systemically to control bacterial diseases of plants. The use of antibiotic compounds for the control of pear blight, peach bacterial spot, and halo blight of beans is highly suggestive. Although much remains to be done in this field, the value of antibiotics to control bacterial diseases has been demonstrated, Dr. Haller concluded.

THE legal counsel for the association, John D. Conner, opened the Friday morning session with a discussion of the industry's responsibilities connected with research and production. He stressed the legal implications of adequate research and production control, pointing out that maintenance of such control is helpful in providing evidence for use when product liability actions do arise,—and can also help to prevent such actions from arising by making sure that only sound products are marketed.

It is the role of research, he counseled, to develop all necessary information to assure that products will be marketed in a safe and effective manner — accompanied by adequate directions for use. The role of production control, he indicated, is to assure that products will be manufactured at all times in accordance with the standards developed by research, and to make possible the identification and further testing of specific products when product liability actions should arise.

These principles, he advised, are particularly applicable to the complex problems presented in the marketing of insecticide-fertilizer mixtures.

CHARLES S. Maddock of the legal department of Hercules Powder Co., spoke on "Responsibilities of Labeling, Advertising and Marketing." He emphasized that information that appears on labels—and in advertising literature—for the industry's products must be based on

SYSTOX*

accepted for use on

POTATOES

SYSTOX has been accepted nationally for use on potatoes at an application rate of ¾ pint (3 ounces active Demeton) per acre. At this dosage SYSTOX gives long-lasting and highly effective control of potato aphid and leafhopper.

* REGISTERED TRADEMARK OF CHEMAGRO CORPORATION

CHEMAGRO CORPORATION

101 PARK AVENUE, NEW YORK 17, N. Y.

factual data developed in research programs. Each product of each company, he suggested, is a separate case in itself and must be treated as such. Directions for use, cautions, etc. must be specific and easily understood. The seller should put himself in the position of the man who is going to use the product,—and give him the information about the product he himself would like to have.

He summarized his view of the seller's responsibility to the buyer with the advice "You don't do your customer or yourself any good by misleading him deliberately or negligently with respect to the efficacy or the safety of your product."

"If you will exercise care in the preparation of your labels and your advertising, to make sure that you have told the users of your products all they need to know, you will have taken the biggest possible step to avoid product liability claims," the speaker concluded.

IN a talk on "Sound Cost Accounting Procedures," Wilson T. Seney, associate, McKinsey & Co., New York, warned that under today's competitive conditions, it is especially important that agricultural chemicals manufacturers follow sound cost accounting practices in determining whether to hold prices at the risk of reduced volume, or to try to maintain volume while cutting prices. Seney presented data which illustrated that mintaining prices at a profitable level is a much more important factor profit-wise than is keeping volume high. He added that use of sound cost accounting practices should minimize the risks of serious losses through unwarranted reductions of volume or price.

Seney advised that, first of all, each agricultural chemicals manufacturer should look carefully at his own profit plans before taking any action on prices. He went on to describe sound cost accounting procedures for the industry, including:

1. Organizing cost facts so they can be used for estimating profit results.

2. Keeping records simple, for quick executive understanding and for rapid issuance of up-to-date reports.

3. Knowing all cost facts, including the ones that cannot always be seen easily.

Seney reminded that many processors, especially among smaller companies, have run into financial difficulties because of failure to keep themselves informed of the facts. For example, some have not forearmed themselves against liability suits based on alleged damages resulting from use of agricultural chemicals. Others have found themselves with piled-up unsold inventory, and as a result have faced excessive warehousing charges. Such hazards as these and other unforseen risks and contingencies could be met better if management planning provided the facts in advance, he concluded.★★

GRANULAR FERTILIZERS

(*From Page 64*)

tures, except possibly in the case of mixtures formulated with individually granulated ingredients.

As granulation technique and processing equipment are improved, granular mixed fertilizers may be expected to become more uniform in particle size and in distribution of nutrients among the various size fractions.

Summary

THE annual U. S. production of granular mixed fertilizers is estimated to be in the neighborhood of 1,000,000 tons and may approach 1,500,000 tons during the coming year. Screen and chemical analyses were made on 29 representative samples of present-day granular mixtures.

The N-P grades and N-P-K grades examined averaged 78 and 64 per cent, respectively, 6 to 20-mesh material: and 6 and 14 per cent, respectively, 20 to 35-mesh material. Distribution of nutrients among the various size fractions was fairly uniform. Nitrogen tended to be distributed more uniformly among the different size fractions than either P_2O_5, which accumulates in the coarse fraction, or K_2O which accumulates in the fine fraction. The greatest deviation from grade occurred with P_2O_5 and K_2O in the highest analysis N-P-K mixtures. Although these variations in nutrient content of the different size fractions indicate that care should be taken to avoid the effects of segregation during sampling, the care necessary probably is no greater than that required to obtain representative samples of non-granular mixtures, except possibly in the case of mixtures formulated with individually granulated ingredients.

Acknowledgement

Grateful acknowledgement is made to fertilizer control officials and members of the fertilizer industry who furnished the samples and to Messrs. William M. Hoffman, Frank O. Lundstrom, Harold Shapiro, and Miss Dorothy Carroll of this Division for the chemical analyses.

INSECTICIDE SAFETY

(*From Page 37*)

1. Every worker who is exposed to any insecticide or any potentially dangerous substance should bathe daily and should wash off any material which spills on the skin.
2. Care should be taken not to inhale any of the materials to which the person is likely to be exposed. Under some conditions respirators may be necessary. Under other conditions they may not.
3. Clean clothing should be worn daily.
4. An operator should never return to the job of applying materials of this type when any symptoms of illness exist regardless of the cause of the illness, whether it be produced by insecticides or by any other agent.
5. If, during the application of any of these compounds, loss of weight, loss of appetite, nausea or vomiting develops, the worker should be seen by a physician even though his work may bear no relationship to his symptoms.

FUNGICIDE STUDIES

(*From Page 50*)

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CHEMICALS in PEST CONTROL

(*From Page 45*)

"To prevent excessive hardship which might come from too much regulation, means that the industry itself will have to be its own policeman. Of course, any policeman has to know what the rules and regulations are that he is supposed to enforce. If the various agencies of the government who are interested in the activities of this industry would set up clearly visible guideposts, I am sure that the industry will do its part."

On Toxicity Scares

"Fear of toxic residues augmented by unscientific scare releases in the press, the publicity in regard to food additives and the like, are causing legislative action to be taken which, in most cases, is not based upon factual information."

"It seems that to date, anyway, the most effective insecticides and fungicides are often the most dangerous to man as well as to insects and fungi. It is imperative that the food supply be protected so until materials which are perfectly safe can be developed, the real protection for the user and the consumer of food products which have been treated with hazardous materials must come through education. Honesty on the part of the manufacturer, plus complete information as to the effectiveness and the hazards of his products placed properly in the hands of the user will keep the government from setting up rules and regulations which will hogtie the industry. To obtain this sort of information requires very extensive research and I know of no other way to get it. Until research gives us perfectly safe insecticides and fungicides, everyone should recognize that we are working with unsafe ones and should conduct himself accordingly."

On Liability

"One of the greatest problems from the standpoint of the investor in manufacturing pesticides is the fact that he, the manufacturer, has no adequate protection against liability in the event of lack of control or damage to crops or neighboring property in the event that the material is improperly used or is improper in itself.

"There are claims amounting to several million dollars hanging over industry at the present time and many insurance companies who write product liability have refused to do so in the case of pesticides, thus leaving many manufacturers, particularly the smaller ones, in a position where they must carry their own liability. This is a burden which could readily wipe them out as individuals almost any afternoon."

On Industrial Research

"Necessity for residue tolerances is appreciated. We feel, however, that the establishment of these tolerances is delayed unnecessarily because not enough recognition is given to the research work performed by industry, and even when the same is done in cooperation with Federal and State agencies. Today, too much duplication of work is in evidence, and this is expensive for the taxpayer as well as for the pesticide industry and for the grower, who is more than an interested bystander."

"It seems evident that with the first development of resistance in house-flies and mosquitos to DDT, that the industry was confronted with a new and complex problem. With the several solutions that have been worked out to this type of problem, the industry has acquired a "know-how" in connection with the development of new controls for resistant insects and I believe we can look forward with confidence to the development of new toxic chemicals more rapidly in the future to be effective against insects that may become resistant to one or more of the currently used chemicals. The industry has learned the pattern to this problem."

"I concur wholeheartedly in the conclusion that expansion of the chemical control of insects must

(*Continued on Page 137*)

continue for the foreseeable future even if you use the word foreseeable in the broadest possible sense. Anything that has been or can be done in the way of developing resistant species of plants and in biological control is bound to be minor at least for a long time to come.

"There is little question that more and more highly specific insecticides will continue to be developed. In fact I think there is an absolute necessity for the development of highly specific materials and for more restricted and intelligent use. Maybe this is going to complicate the industry to an almost unbearable extent, but I can see no other way out."

The insecticide industry provides new and better chemicals through costly research. They have changed formulation from an art to a science. Their improved distribution systems have made supplies of pest control chemicals available on short notice and in remote parts of the world. They are financing significant amounts of experiment station research and graduate study. Graphic films and displays produced by the industry help the extension entomologist tell his story more effectively. And perhaps most important of all, the insecticide manufacturers are offering employment of a high professional level to an ever-increasing number of entomologists.

Both industrial and tax-supported entomological research seem to offer much toward the solution of our expanding problems in the chemical control of insects. This research can be made most effective only by mutual understanding and cooperation. From the viewpoint of industry, we need the help and understanding of professional entomologists everywhere in our special burdens of restrictive legislation, toxicity scares, and liability. Without your support in these matters, industrial research will go backward instead of forward and the science of the chemical control of insects will stagnate for lack of better insecticides.★★

A. C. S. MEETING

(*From Page 65*)

may be added to, and applied with, the fungicidal formulation; and, if this is done, will the two mixtures be physically and chemically compatible?

Problems Related to Toxicity Studies of Pesticides and Formulations. *L. W. Hazleton, Hazleton Laboratories, Falls Church, Va.*

In developing an adequate experimental design for the toxicological evaluation of a new pesticide the preferred formulation plays an important role. The experimental design usually includes comparative tests on the purified chemical, the technical, or commercial grade, and the typical formulations, and each of these presents its own problems of investigation and interpretation.

The physical state of the pesticide is a very important factor of toxicity and is influenced by formulation and/or method of application. Aerosols of low volatility liquids may be toxic. Nontoxic aerosols may serve as carriers of toxic vapors.

Because the final evaluation of safety for a pesticide on food crops is based on the residue level at harvest, the formulation must bring into accord the entomological, economical and toxicological objectives. This necessitates close cooperation between chemist, formulator and pharmacologist throughout the entire development program.

Industrial Hygiene Control in the Manufacture of Pesticides. *William R. Bradley, Industrial Hygiene Section, American Cyanamid Co., N. Y.*

The role that industrial hygiene has played and continues to play in the manufacture, formulation and use of the newer pesticides is discussed. Particular mention is made concerning the manufacture, handling and use of the new organic phosphate insecticides along with other pesticides that are toxic to humans. Industrial hygiene is concerned with providing and maintaining healthful conditions for work in industry.

Toxic pesticides can be manufactured and handled safely when adequate control of the working environment is established in order to avoid exposure to workers. This is possible when pesticide plant design engineer, toxicologist, physician and industrial hygienist, together with production and operating personnel, discuss worker health protection and make their plans together when anticipated pesticide production still is in the blueprint stage.

In the case of organic phosphate insecticides, information from animal toxicological experiments and its inter-

pretation by the physician showed the industrial hygienist what environmental control measures must be established for their manufacture. It was necessary that the industrial hygienist develop trace air sampling and analytical techniques for use in studying the manufacturing, formulation and application environments as proof of the prevention of worker exposure. Also developed were personal protective equipment including respirators for the worker's use. Thus the application of the principles of industrial hygiene made possible production, marketing and eventual use of the newer, more toxic pesticides.

Hydraulic Spray Equipment. *Frank Irons, U. S. Department of Agriculture, Division of Agricultural Engineering, Toledo, Ohio.*

Hydraulic spraying with ground machines is one of the most common methods of applying pesticides to agricultural crops and is frequently used as the standard for comparison of other application methods. The equipment requirements are directly influenced by the pesticide formulation as well as the crop and pest. The recent introduction of new pesticides capable of effective use at low gallonages per acre has resulted in rapid development of concentrate spraying machines. This paper includes a general description of the different types of hydraulic sprayers and their component parts and the functions of the various parts in relation to the performance requirements.

Ground Dusting Equipment. *Clifford O. Eddy, Niagara Chemical Division, Food Machinery & Chemical Corp., Middleport, N. Y.*

The ground dusting machine consists of a dust hopper, an agitator, and a feeding device to deliver the dust to a fan which disperses and propels it toward the area to be treated. The ground dusting machine is a leading pesticide applicator particularly for the control of fruit and truck crop pests, for certain field crop pests, and for the general use of the small farmer. The simple types of dusters range from the sifter-top can through the rotary hand gun to the traction-type duster. The power units vary greatly in size and type from the small self-propelled garden duster to the large trailer-type with direct power or power take-offs.

The addition of a liquid atomizer to the duster makes it suitable for applying either a liquid or a dust or a combination of the two.

With the coming of the new organic pesticides, dusting machines must meet the challenge of chemicals that can control pests at ounces rather than pounds of active ingredients per acre, possibly through research in dispersion, metering devices, electrostatics, and the use of tracers.

Aircraft Sprayers and Dusters. *Fred E. Weick, Texas A. and M. College System, Engineering Experiment Station, Personal Aircraft Research Center, College Station, Tex.*

Some general facts regarding agricultural aviation are given, including the numbers and locations of the dusting and spraying operators, the growth of the activity, and the main crops treated. The types of airplanes in present use are mentioned, and the development of airplanes for the special purpose of dusting and spraying is reported, particularly the Ag-1 experimental agricultural airplane which was sponsored by the U. S. government and designed and constructed at the A. and M. College of Texas.

Emphasis is placed on the need for an excellent field of view for the pilot, protection for the pilot in case of crash, easy loading and simple maintenance.

A measuring station is described for weighing directly the quantity of spray or dust deposited on sample areas and determining the distribution pattern for a single swath. Typical results are compared with optimum patterns. Means for obtaining optimum patterns are discussed.

Topics of other talks of interest to the industry, and the speakers, included the following:

Chemical Determination of Aldrin in Crop Materials, A. E. O'Donnell, Shell Development Co., Emeryville, Cal.; Method of Evaluating Emulsifiability of Emulsible Insecticide Concentrates, B. I. Sparr and C. V. Bowen, BEPQ, Bethesda, Md.; Physical and Chemical Properties of Organic Pesticides as Related to Formulation and Application, Lloyd L. Isenhour, Rohm & Haas Co., Philadelphia, Pa.; Role of Surfactants and Solvents in the Formulation of Liquid Pesticides, Lynn K. Brunn, Atlas Powder Co., Wilmington, Del.; Some Aspects of the Deposition of Pesticides on Plants, O. I. Berge, University of Wisconsin, Madison, Wis.; Effective Application of Chemicals with Air Sprayers, James P. Carr and Joseph M. Patterson, John Bean Division, Food Machinery and Chemical Corp., Lansing, Mich.; Equipment Problems and Materials of Construction, William H. Zehner, The F. E. Myers & Bro. Co., Ashland, O.; Herbicide Application and Equipment, L. L. Coulter, Agricultural Chemical Development, The Dow Chemical Co., Midland, Mich.; Some Equipment Aspects of the Pre-Emergence Application of Wettable Powder Herbicides, L. E. Creasy, Grasselli Chemicals Department, E. I. duPont de Nemours & Co., Inc., Wilmington, Del. and Metal Inactivators and Synergism, J. C. Cowan, Northern Regional Laboratory, Peoria, Ill.★★

FERTILIZER FUTURE

(*From Page 41*)

ing crops which can make better use of high levels of fertility. This is not beyond the realm of possibility.

The use of insecticides in fertilizers offers considerable promise for controlling soil insects. The remarkable success in controlling corn root worm by this method is encouraging for greater success in the future.

In the future the younger men in this group today will, in discussing fertilizer analyses, be using N, P and K instead of the conventional N, P_2O_5, and K_2O. Then someone in the group will say: "I can remember during the early 1950's listening to Professor Emil Truog, the eminent soil scientist from the University of Wisconsin, extol the virtues of this method of expressing the fertilizer analysis. At that time many of our elders agreed, but because of tradition, were hesitant to support the forward step at that time. The transition from P_2O_5 to P and from K_2O to K was made as easily during our time as was the transition from NH_3 to N during the time our fathers and grandfathers operated the business."★★

CONTINUOUS PROCESS

(*From Page 48*)

oversize recycle, which has been referred to in connection with the description of the conditioning paddle mixer, is returned to the paddle mixer. A positive feed control system operates to prevent fluctuating dryer feed and to maintain a constant recycle load. Temperature of the dryer feed is 95 to 105° F., and its moisture content varies from 6% in the high nitrogen grades, to 13½% in the low nitrogen grades.

The dryer is a rotary, externally heated system of the louvre type, manufactured by the Link-Belt Company, receiving hot drying gasses behind the louvres, passing them up through the revolving load of granules, and discharging them through cyclone dust separators. Inlet air temperature, for the drying process, is limited to 350° F. for the high nitrogen, low moisture grades, and 500° F. for the low nitrogen, high moisture grades, in order to prevent the possibility of softening and sticking of the granules to the

louvres with consequent decomposition, reversion of the pentoxide, and loss of nitrogen. The product temperatures range from 175° to 200° F. Such a temperature system lowers the moisture of the product to less than 2% without determinable loss of nitrogen, or loss of available phosphoric acid, due to reversion to a citrate insoluble form.

It then is necessary to cool this product under 105° F. to prevent reversion of the pentoxide in bulk storage, or to prevent deterioration in paper bags, if bagged direct from the dryer.

The product as it comes from the cooler has particle sizes as shown by this typical screen analysis:

MESH	%	MESH	%
+6	0.	+20	30.
+8	24.	+35	14.
+10	26.	+60	5.

It it is considered advisable to screen out the finer fractions, the screenings should be returned along with the dust from the cyclones to the front end of the slurry mixer with sufficient water to compensate for the water, which had been removed from these fractions.

The following ratios have been produced in various concentrations of plant food: 2-1-1, 1-1-1, 1-2-1, 1-2-2, 1-2-4, 1-3-9, 1-4-0, 1-4-2, 1-4-4. All ratios have satisfactory physical properties for bulk or bagged storage or drilled application to soils.

Hygroscopicity is very low, which is explained by X-Ray diffraction patterns made by Mr. Henry Terford under the direction of Dr. Geo. L. Clark at the University of Illinois. These patterns show the reaction of ammonium nitrate with potassium chloride so nearly complete as to leave insufficient ammonium nitrate for identification by X-Ray.

X-Ray diffraction of a 12-12-12 fertilizer shows all the nitrogen present in the following combinations: NH_4Cl, $(NH4)_2SO_4$, KNO_3, mono-ammonium phosphate, di-ammonium phosphate, and potassium ammonium phosphates with very slight evidence

Conventional Process		Continuous Process	
Formulation 4-16-16			
	Cost		Cost
132—45.5% Sol. A.	$ 4.42	233—30% NH_3	$ 3.25
100—Conditioner	.58	61—"C" Sol. 37	1.60
96—Ammo. Sulph.	2.56	—	—
978—22.5 super.	11.34	1420—22.5 super.	16.48
217—46% conc. super.	6.34	18—filler	.07
517—62% K_2O	9.67	517—62% K_2O	9.67
2040		2249	
40 Loss		249 Loss	
2000	$34.91	2000	$31.07
Formulation 12-12-12			
132—45.5% Sol.	$4.42	650—Sol. 37%	$16.98
124—Conditioner	.71	—	—
874—Ammo. sulph.	23.25	—	—
522—46% conc. super.	15.24	93—conc. super.	2.72
—	—	881—22.5 superphosphate	10.21
388—62% K_2O	7.25	388—62% K_2O	7.25
—	—	138—100% H_2SO_4	1.66
2040		2150	
40 Loss		150 Loss	
2000	$50.87	2000	$38.82

of NH_4NO_3. The phosphates are present as ammonium phosphates, tricalcium phosphate, and potassium ammonium phosphates. Potash is present as KNO_3 and potassium ammonium phosphates with slight evidence of KCl.

The hygroscopicity is reduced also by the nearly homogeneous distribution of the ammonium nitrate in the product, which results from mixing it intimately while in solution with the finely divided dry materials and subsequent crystallization from solution throughout the mass.

Saving in raw materials cost over conventional fertilizers ranges from $3.80 per ton of 4-16-16 to $12.05 per ton 12-12-12. The lower material costs are due to the use of cheaper sources of nitrogen and the use of a larger proportion of normal superphosphate, to the more expensive concentrated form of pentoxide.

The savings are shown by the typical formulas which appear in the table on Pg. 139.

Summary

The process produces all ratios of fertilizers in a very high degree of plant food concentration. Its process allows a wide range of particle sizing.

Fertilizers will store over indefinitely long periods in bulk or bags without fear of cementing together, even when piled 20 bags high or in silos a hundred or more feet in height. This assures perfect drilling condition in the fields.

The fertilizers may be packed in paper bags, used normally in the fertilizer industry, either open mouth or valve.

Large savings are made in the cost of nitrogen by utilizing low cost ammonia and ammonia nitrate solutions as the sole source of nitrogen.

Large savings are made in the cost of pentoxide because the high concentration of ammonia and ammonium nitrate permit a larger proportion of pentoxide to be derived from lower cost normal superphosphate.

No period of curing is necessary, allowing greater turnover of storage and saving of storage facilities and costs.★★

LISTENING POST

(*From Page 72*)

seed treated with dry copper carbonate. The second test produced the same general differential among the three treatments but the germination percentages were higher.

With respect to varieties, the winter wheats were more adversely affected by the copper carbonate slurry treatment than the spring wheats. This was especially true at 3°C.

These results suggest the need for more thorough testing of fungicides before making recommendations on different methods of application. It has been assumed that copper carbonate slurry would, like the dust treatment, be non-toxic to wheat seed. However, according to these data, copper carbonate slurry is injurious to wheat seed, particularly under low temperatures.

Head Smut Control In Mountain Brome

JACK P. Meiners and Sherl M. Dietz report the results of 1953 cooperative seed treatment tests to control head smut caused by *Ustilago bullata* in mountain brome grass *(Bromus marginatus)*, conducted by the Washington Agricultural Experiment Stations and the U. S. Department of Agriculture.

The results, summarized in Table 2, (Pg. 143) are similar to those obtained in the preceding year. One new material, "Setrete," was tried in 1953. The volatile mercurials, "Panogen" and "Ceresan M," at certain dosages gave adequate control, whereas "Arasan," "Arasan SF," "Setrete," and "Mergamma" did not provide effective control at any dosage.

"Ceresan M" was tried at several dosages, both as a slurry and as a

TABLE 2

Effect of Seed Treatments on the Incidence of Head Smut in Bromar Mountain Brome.

Material	Dosage oz. bu	Method of application	Slurry conc. lbs./gal.*	Bu. seed/ gal. slurry	Per cent smut
Untreated	—	—	—	—	100.0
Ceresan M	0.5	Slurry	1	32	11.3
	1	"	2	32	2.5
	0.5	"	0.5	16	0.4
	1	"	1	16	0.0
	1.5	"	1.5	16	0.0
	0.5	Dust	—	—	0.9
	1	"	—	—	0.9
	1.5	"	—	—	0.0
	2	"	—	—	0.0
Arasan SF	4	Slurry	4	16	15.0
Arasan	4	Dust	—	—	2.5
	6	"	—	—	5.3
Panogen	0.5	Slurry	1	32	12.6
	0.75	"	1.5	32	5.3
	1	"	2	32	2.1
	0.5	"	0.5	16	4.6
	0.75	"	0.75	16	0.5
	1	"	1	16	0.3
	0.5	Liquid	—	—	11.7
	0.75	"	—	—	0.7
	1	"	—	—	0.3
Setrete	1	Slurry	1	16	92.0
Mergamma	4	Dust	—	—	11.0
	6	"	—	—	6.1

*Pounds of material per gallon of water

dust. At one ounce or more per bushel, the dust eliminated the smut. In the "Ceresan M" slurry treatments, different slurry concentrations at different dosages were compared. The more dilute concentrations at each dosage were most effective, probably because of better coverage obtained with the greater volume of slurry. The smut was reduced to less than one per cent at the ½ ounce per bushel rate, and was eliminated at one ounce or more per bushel, when the slurry was applied at the rate of one gallon per 16 bushels of seed.

Similar results were obtained with "Panogen." This material was applied at various dosages as a liquid (undiluted), or slurry. It did not completely eliminate the smut at any dosage, but at ¾ ounce or more per bushel, either the undiluted liquid or the slurry, when used at the rate of one gallon per 16 bushels of seed, reduced the smut to less than one per cent.

"Arasan," which has been recommended for control of head smut, did not eliminate the smut, although it reduced it considerably. However, on the basis of the results from the tests during both years, it does not give adequate control, and can no longer be recommended.

On the basis of two years' results, which were nearly identical, "Ceresan M" and "Panogen" are recommended for treatment of mountain brome seed to control head smut. "Ceresan M" may be used either as a dust or a slurry, and "Panogen" may be used in concentrated or dilute form. The dosage, in any case, should be one ounce per bushel, and the slurry should be used at such a concentration that not less than one gallon is applied to 16 bushels of seed. ★★

WASHINGTON REPORT

(*From Page 69*)

is important is that more and more attention is being given antibiotics. It may mark an important trend.

• • •

Congratulations to Val Weyl, information director NAC, for his "new look" in the NAC news. He now has a bit more space in which to condense the important actions of the Association and the industry. The result is a new improved, more readable and entertaining paper.

POTASH PROGRAM

(*From Page 13*)

tions the agricultural industries, government representatives, Pan American Union representatives, large consumers of agricultural products, land owners, etc. . . . and thus analyze the specific agricultural requirements of our neighbors . . . and of course set the stage for education in fertilizer application, as well as in use of insecticides, herbicides, fungicides, etc.

Mr. Zeigler, who has an extensive background in the agricultural field, has also lived in Bolivia for five years and has a working knowledge of the language, the people and the customs. He was formerly manager of the chemical division of the Naco Fertilizer Co., a division of W. R. Grace & Co.

Mr. Zeigler will give his initial report to the Association later this spring, after he returns from this South American trip.

•

New Bell Kaolin Co.

The formation of the Bell Kaolin Co., in Aiken County, S. C. was announced late last month. The new organization will produce air-floated kaolin for insecticides, ceramics and rubber industries. Robert W. Roff will be vice president and general manager.

•

2 Fungicide Names Adopted

The Interdepartmental Committee on Pest Control, of the American Phytopathological Society, announced late last month the approval of two common names for fungicides. "Dichlone" is approved for 2,3-dichloro-1, 4-naphthoquinone; and "Glyodin" is approved for 2-heptadecyl glyoxalidine acetate.

•

Nitrogen Policy Reviewed

The government policy of issuing rapid tax amortization certificates to encourage nitrogen industry expansion was discussed March 22 by industry representatives with officials of the Office of Defense Mobilization. Industry representatives asked for the meeting, which was arranged by Harold E. Smith, director of the chemical and rubber division of the Business and Defense Services Administration. The group discussed issuance of additional tax certificates in the nitrogen industry.

New S.A. Fertilizer Plant

A new fertilizer plant, which will utilize industrial waste products, garbage and other vegetable products, has been opened in Quito, Ecuador. It will produce 2,000 tons of a complete chemical fertilizer a year. The company says it expects rapidly increasing demand for fertilizer by Ecuadoran farmers will lead to expansion of the Quito plant.

•

New Cominco Plant Operating

Consolidated Mining & Smelting's new Kimberley, Canada, fertilizer plant recently started production. Additional expansion in fertilizer plants at Trail and Calgary has increased Cominco's capacity to a potential of 400,000 hp. Shipments to Western U. S. increased from 250,000 tons in 1947 to 450,000 tons fertilizer in 1953.

Weed Group Meets

New chemicals for weed control and problems involved in applying herbicides were discussed at the 14th Western Weed Control Conference March 22-24 at Tucson, Ariz. Representatives from many western states heard leading industry and educational experts discuss the status of weed control in the West at meetings held on the University of Arizona campus. The conference was held in conjunction with the Western Seed Officials Association.

Highlighting the sessions were talks on the costs of weeds, by D. C. Myrick, Montana State College; legislation and weed control, a panel moderated by J. Bryant Anderson, Utah Coop. Assoc.; new chemicals for weed control, Dr. Newman, Camp Detrick, Frederick, Md.; and problems of aerial application of herbicides, by John F. Neace, March Aviation, Phoenix, Ariz.

Other talks at the conference included the effect of 2,4-D on the growth and development of cotton, H. Fred Arle, USDA, Phoenix; borate-chlorate mixtures as herbicides, L. M. Stahler, Pacific Coast Borax Co.; CMU in the soil, Dr. L. E. Cowart, E. I. duPont Co. and a panel on new developments in controlling perennial weeds, moderated by Lowell Rasmussen, Washington State College. The delegates also saw a film entitled "Weed Control in Cotton with Chloro IPC", presented by Columbia-Southern Chemical Corp.

Other panel sessions were devoted to questions and answers on control of weeds in various crops in sections of the West.

•

Potash Deliveries Up

An increase of five per cent in deliveries of potash in North America in 1953 over 1952 was reported last month by the American Potash Institute. The Institute said deliveries last year totaled 3,230,667 tons of salts containing an equivalent of 1,879,626 tons of K_2O. Deliveries by the seven leading domestic producers were the highest ever recorded, amounting to 1,722,728, tons K_2O, an increase of nine per cent over 1952, while imports were down 26 per cent from 1952.

•

Power Sprayers at Record High

An all-time high of 530,000 power sprayer units are being used on United States farms, a recent issue of *Farm Implement News* stated. The range of spraying jobs in general farming operations has increased with new developments in insecticides, herbicides, and other pesticides.

•

Borax Appointments

Two appointments to high positions were announced last month by Pacific Coast Borax Co., Los Angeles. Maurice H. Pickard was named director of technical service and product development and Roger W. Hinchman was appointed eastern sales manager, industrial division. Mr. Pickard joined the company in 1936 as chief chemist in the Boron, Cal., plant while Mr. Hinchman came to Pacific Coast in 1943.

Superphosphate Output Up

Domestic production of superphosphate in January amounted to 181,074 short tons, the U. S. Census Bureau announced late in March. The figure represents an increase of seven per cent over the December, 1953 output, and a four per cent increase over the production figure reported for the corresponding month of 1953.

•

Defoliating Cotton

Best methods of defoliating cotton plants in the western portion of the cotton belt will be given growers in the area April 13-14 when farmers and technologists meet at Phoenix, Ariz., at a conference sponsored by the Arizona Growers Association.

•

Care & Storage of Bags

Fulton Bag & Cotton Mills, New Orleans, have recently prepared a booklet on the care and storage of multiwall paper bags, which outlines some of the problems in bag handling, and lists suggestions on how to avoid some of these difficulties.

Classified ADVERTISING

Rates for classified advertisements are ten cents per word, $2.00 minimum, except those of individuals seeking employment, where the rate is five cents per word, $1.00 minimum. Address all replies to Classified Advertisements with Box Number, care of AGRICULTURAL CHEMICALS, 175 Fifth Ave., New York 10. Closing date: 25th of preceding month.

Situations Wanted:

FOREIGN SALES AND DEVELOPMENT REPRESENTATIVE: Agronomist with wide experience in soils and agricultural chemicals seeks job as sales and development representative in Spain or any other Latin American countries. Spanish spoken fluently. Will consider offer in foreign export and sales department of agricultural chemical firm. Address Box No. 846 c/o Agricultural Chemicals.

AQUATIC PLANT PHYSIOLOGIST with Ph. D. degree, 10 years research with field experience. Qualified to handle various problems pertaining to water plant growths. Address Box No. 847, c/o Agricultural Chemicals.

AGRONOMIST: Wide field and greenhouse testing of herbicides. Formulated pesticides. Chemical, plant physiology and soils background. Prefers technical service or development. Address Box No. 848, c/o Agricultural Chemicals.

Positions Available:

AGRICULTURAL CHEMIST (FERTILIZERS) wanted for metropolitan New York area. Experienced in manufacturing of superphosphate fertilizers. Initiative to promote surface active chemicals to phosphate manufacturers. Duties will involve laboratory development and evaluation along with customer service. Address Box No. 849, c/o Agricultural Chemicals.

Miscellaneous:

EXPORT REPRESENTATION: Exclusive basis—seeks firm with worldwide agents in agricultural chemicals, fertilizers, insecticides, equipment, etc. Address Box No. 851, c/o Agricultural Chemicals.

WANTED: 33% Ammonium Nitrate. Premium Prices. Address Box No. 852, c/o Agricultural Chemicals.

For Sale:

STEEL TANKS FOR SALE: Dished heads—all welded. Excellent for storing liquid fertilizer, chemical, etc. At Norfolk, Va. (3) 5800 gal; at Tonawanda, N.Y. (2) 7000 gal; at Brooklyn, N.Y. (10) 7650 gal; at Reading, Pa. (9) 4600 gal, (5) 4300 gal, (2) 3800gal; at Philadelphia, Pa. (3) 13,700 gal, (4) 9150 gal, (2) 4400 gal. Perry Equipment Corp., 1428 N. 6th St. Phila., 22, Pa.

FOR SALE: 15,000 lbs. Chlordane 50% Wettable Powder, packed in fibre drums, for immediate sale in minimum quantities of 2,000 lbs. at 43¢ per pound, with minimum freight allowed. Material compounded by a foremost insecticide manufacturer. Address Box No. 850, c/o Agricultural Chemicals.

N. C. E.S.A. MEETING

(*From Page 53*)

least two possibilities: First, the insect may, by definite choice or altered habit, avoid contact with the toxicant. An example of this situation would be an insect that is repelled by the toxicant or its formulation. Second, the insect may be able to withstand larger amounts of the toxicant on or in its body."

"This latter case best represents true resistance. Its evaluation should be carried out in the laboratory where the insect is brought into contact with more or less known amounts of the toxicant. The methods employed should be such that the insect has no choice but must acquire a definite amount of toxicant equal to or greater than that acquired by the predecessors or 'normal individuals.'"

In discussing the organic phosphates as fly killers, Curtis Wingo of Missouri stated: "In 1953 baits and baited sprays were markedly effective only in situations where ideal sanitation methods were possible. Even under ideal conditions of sanitation, baits, which are applied by sprinkling can to floors or burlap hangings, may be effective only if applied two to three or even four times a day. Under the high mid-season temperatures of 1953 the bait often dried on the floor within 30 minutes and on the burlap within two hours. After drying, these baits were found to give no appreciable control. Baited sprays (50 per cent emulsifiable Malathion one pint, sugar three cups, and water six gallons) were found to remain toxic for not more than four days when applied to resting places, walls and floors of farm buildings. Often, no substantial kill of flies was recorded 24 hours after application. This baited spray was found to be an excellent larvicide.

"In the 1953 field tests malathion appeared most promising when used as a bait with dark Karo syrup applied to window blind suspended from the ceilings of dairy buildings. Malathion 50 per cent emulsifiable and dark Karo syrup mixed half and half was used to treat the blind cord on the day preceding placement in the buildings. Approximately 150 feet of cord hung in one foot lengths were used per 320 sq. ft. of floor space."

"As a general class the present available organic phosphates seem unsuitable for use as residual sprays for fly control. The single exception we have encountered is the material known as diazinon. Field tests in 1953 showed diazinon at one per cent to provide good control when used in over-all applications as a residual spray. Good control was obtained for a 35-day period in situations of very poor sanitation. Baits and baited sprays had failed to give appreciable control in these places. Diazinon at 1 per cent applied as a spot treatment of roosting places was found to be ineffective under conditions of poor sanitation but does give good control when sanitation was good. Residues of diazinon were found to lose toxicity rapidly after two weeks exposure to direct sunlight and/or high temperatures (i.e. 100° F). No resistance to diazinon was found in a house fly population exposed continuously to deposits of the insecticide for a period of 97 days."

"Recent investigations of the so-called 'salt-and-pepper' application of dry sugar baits made with diazinon, malathion, or Bayer L 13/59 indicate that little control may be expected from this method unless natural attractants present are taken into consideration and eliminated as far as possible. Competition is a factor that has apparently been ignored or overlooked in many cases involving the use of baits in house fly control."

A general discussion on fly control by the entomologists indicated that, on the farm, malathion will be the general recommendation as a spray for fly control. This will have to be accompained by good sanitation, larvicides, space sprays of pyrethrins, aerosols and possibly some baiting.

In the final business session Purdue University was selected as the site for the 1956 meetings which may be of three days duration, H. H. Gunderson of Iowa State College was elected Chairman-elect for 1956, J. W. Apple, University of Wisconsin, Branch representative to National Governing Board, and R. E. Hill of the University of Nebraska, representative to the executive committee of the Central States Branch.★★

THROUGH THE SIFTER

(*From Page 58*)

entomologically trained readers have no doubt long since noted. It slipped by us too, until just too late to suggest a correction. And in the "confusam" the compositor also coined a new pesticide,—"2,4 Di Chlordane." A real ominous sounding merger.

* * * * *

Lew Gemmell of Geigy and John Van Geluwe apparently take their fishing and hunting seriously. They have recently acquired some virgin (crown) land in upper Canada, a couple days hike northwest of Toronto, and plan to build a cabin up in this wilderness where they can get away from it all when the insecticide business gets too depressing.

* * * * *

Our agents advise us that Mathieson has just acquired the anti-freeze division of U. S. Industrial Chemicals Co., division of National Distillers.

* * * * *

Leo Gardner, vice-president and manager of research and development for Calspray, came to Houston to talk safety, and brought with him a couple good ideas on the subject. First off he reported that, contrary to the press reports on the sad west coast fatality of a few weeks ago, the doctor treating the case had thoroughly adequate information on the toxicity of the material which had been ingested (TEPP) and all necessary information on treatment indicated. Mr. Gardner suggests, however, that to provide every safeguard against such fatalities the industry should maintain service at some central point, on a 24-hour basis, where information on toxicity of various pesticide materials and recommended treatment would always be available. He also urges pesticide manufacturers to hammer away at users to keep their stocks of pesticides under lock and key right up to the moment of application.

* * * * *

Our meeting story this issue carries no account of the very fine talk which, we hear, Joe Burger of Corneli Seed Company gave as the concluding address of the convention. No, your reporter did not leave early. The explanation is that Thursday and Friday sessions were closed and Mr. Burger had no paper as such, so it was a little difficult to report. Mr. Burger explained: "Mine will not be a paper. We Missourians speak 'off the cuff.' In fact we have one (recently deposed) rather prominent Missourian who was notorious for his 'off the cuff' speeches and remarks."

Index to ADVERTISERS

(The Advertisers' Index has been checked carefully but no responsibility can be assumed for any omission)

Tale Ends

Houston, Tex., March 25. As members of N.A.C. met in the fabulous Shamrock Hotel for their annual spring meeting, they were talking in the meeting rooms about the Miller Bill, sound cost accounting procedure, the credit situation, et. al., — but in the corridors and the smoke filled rooms they were just talking about the weather. They were talking about it, however, as agricultural insecticide salesman will, — in a very business like way.

* * * * *

And the general tenor of most of these conversations was: "Man, give us a warm, moist spring. We want to see a nice fat cotton crop,—with lots of weevils eatin' on it. For we can't stand another of those hot, dry, years that burns up the cotton, burns up the weevils and burns up the insecticide business all at the same time."

* * * * *

Corridor gossip included a revival of the prediction that next year N.A.C. may abandon the general spring session and substitute a series of regional meetings. But wouldn't that just mean that for most of us it would be four or five meetings to attend instead of one? The most cheers the corridor balloters raised on any single question was when a motion was entered that it's about time we go back to Florida in '55.

* * * * *

What's wrong with the business that a good bug year won't cure? One attitude could well be changed, observes one of our agents. There are still too many people making insecticide who don't look on it as a "market," — to be nurtured, cultivated and encouraged, — but rather just as some place to put excess chlorine and benzol when it's convenient.

* * * * *

A BRONZE "JOSHUA" plaque for the most distinguished use of book advertising in the chemical industry in 1953 has been awarded to Geigy Agricultural Chemicals, division of Geigy Co. It was awarded by the Match Industry Information Bureau.

* * * * *

When "Grub" Leonard resigned his position as vice-president of Virginia-Carolina Chemical Corporation last year, and announced his retirement from the insecticide business, he indicated that among other things he might find a little more time for fishing. And during February he made good on the threat. Fishing out of Marathon, Fla., aboard the Gertie T, "Grub" or "Rusty" as he has been known since the NAC's visit to New Orleans last year, boated a 32-lb. amberjack, along with various other lesser specimens. And "Grub" allowed as how the "jack" gave him as much of a fight as some of the more troublesome nicotine buyers used to.

Bemis B-FLEX

A Better Multiwall Valve Bag FOR LESS!

Look at these B-FLEX benefits:

LOWER BAG COSTS . . . Save up to $2.50 per thousand.

FASTER PACKING . . . LOWER PRODUCTION COSTS.

UNIFORM WEIGHTS . . . stop over-packing.

MINIMUM SIFTING.

CUSTOMER SATISFACTION . . . no loose, torn sleeves to get into the farmer's drill.

Ask your Bemis Man for the *complete* B-FLEX story.

With Bemis B-FLEX Bags, you also get the same bonus you get with all Bemis Multiwalls—**BEMIS MULTI-COLOR PRINTING** . . . your brand at its finest on multiwall bags.

Bemis

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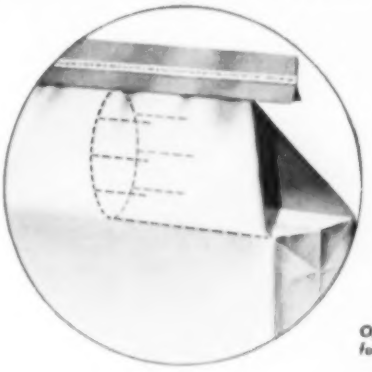
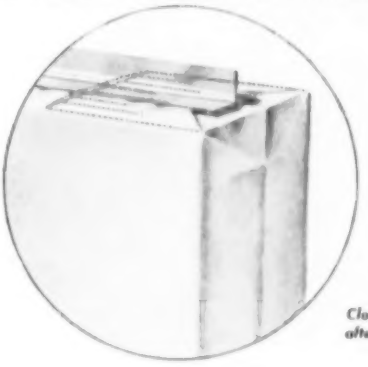
Here's Why It's Better . . .



Open . . . for filling

The FLEX Does the Trick . . .



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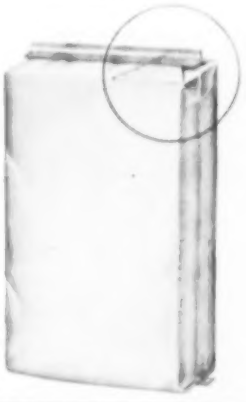
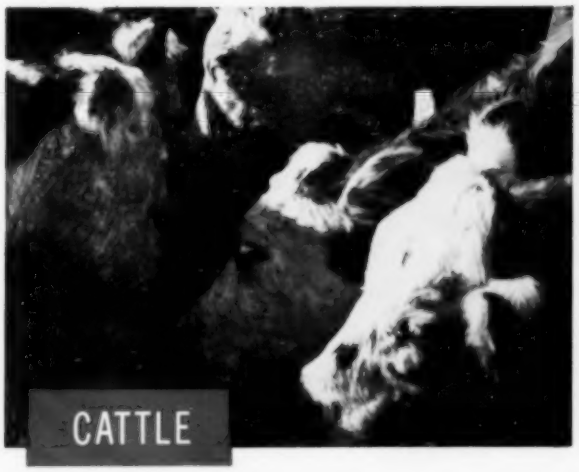


TOXAPHENE PROTECTS

FOOD, FEED, AND FIBER CROPS



Wherever you live, it's probable that the crops grown there can benefit from insecticides based on toxaphene (chlorinated camphene 67-69% Cl). Recommended for effective control of more than 150 different species of insect pests, toxaphene dusts and sprays are helping to protect food, feed and fiber crops —to increase yields throughout the world.

Naval Stores Department

HERCULES POWDER COMPANY

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